Trauma in Washington State

A chart report of the first ten years, 1995-2004

March, 2006

Health Systems Quality Assurance
Office of Emergency Medical Services and Trauma System

Contents

Purpose

The purpose of this report is to provide the trauma services community and the public at large with information relating to the status of the Washington Trauma System. The focus is statewide, covering patient demographics, injury characteristics, prehospital and hospital care, and outcomes. This report provides descriptive information for the first 10 years of the trauma system (1995-2004). Records included in this report meet the statewide trauma registry inclusion criteria (see appendix A) and represent more than 120,000 patient encounters.

Background

Trauma is a disease of epidemic proportions. Each year, over 140,000 Americans die from this killer. It has been aptly called the last major plague of the young as trauma kills more Americans between the ages of one and thirty-four than all other diseases combined. But trauma is more than a plague of the young: Trauma is the leading cause of death for all people under age forty-four, and the leading cause of disability for all people under age sixty-five.

Thirty to forty percent of all trauma deaths occur within hours of the injury, usually from shock and/or internal bleeding. Many of these deaths are considered preventable as a result of an effective, organized trauma system. Moreover, all trauma deaths, and particularly those which occur within minutes of injury and for which there are no effective medical treatments, could be avoided through appropriate injury prevention actions.

Washington’s trauma care system aims to assure that the required resources are available and the necessary infrastructure is in place to deliver the "right" patient to the "right" facility in the "right" amount of time. This system is built upon broad consensus and cooperation among divergent groups and around complex logistical, political, financial, legal and medical issues. Washington’s system is comprehensive and includes a strong injury prevention component as well as the designation of rehabilitation services for post-acute trauma care.

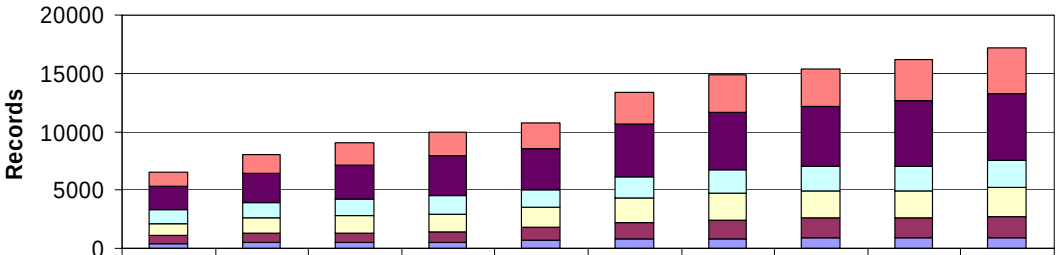
Washington’s trauma system is currently operational. Community-based prevention projects have been implemented statewide, trauma care facilities have been designated, the statewide trauma registry is in place, and regional quality assurance/improvement committees are meeting to address trauma quality issues at a local level.

Patient Demographics

Age

Trauma affects people of all ages and is the leading cause of death among persons aged 1-44 years. The mean (average) age of trauma patients in Washington has increased from 38 years in 1995 to 42 years in 2004. The median age has also increased during this time. Consistent with an aging Washington population, the trauma registry data highlight a trend towards more trauma in older adults.

Table 1. Trauma volume by age and year

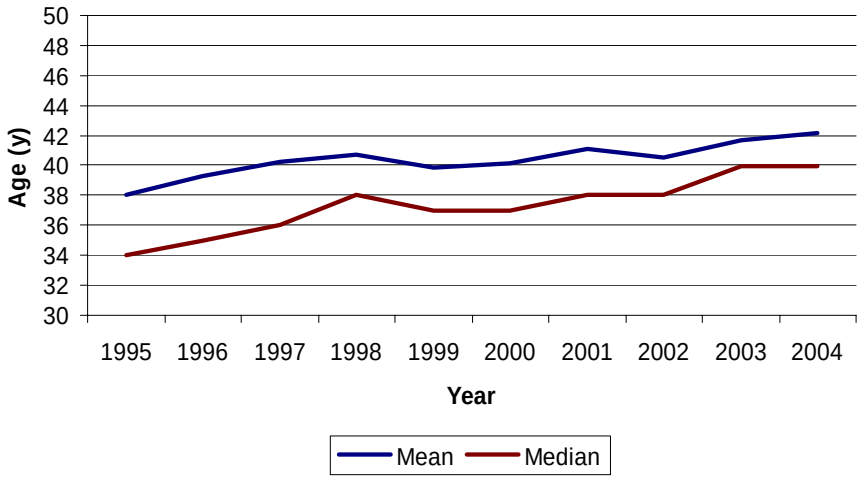


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
65+	1,175	1,624	1,890	2,071	2,187	2,710	3,239	3,193	3,525	3,920
35-64	2,070	2,497	2,919	3,369	3,519	4,500	4,976	5,194	5,600	5,768
25-34	1,184	1,338	1,414	1,632	1,547	1,840	1,966	2,101	2,067	2,322
15-24	1,010	1,277	1,476	1,477	1,695	2,061	2,303	2,264	2,321	2,500
5-14	672	846	854	913	1,131	1,478	1,615	1,724	1,747	1,806
0-4	415	482	481	534	657	763	813	927	894	920

Year

The mean and median age of trauma patients are increasing. In part, this reflects more elderly fall patients meeting the criteria for entry into the trauma registry. While hospitals are not required to submit data for patients with isolated hip fractures, many elderly falls result in additional injuries.

Table 2. Mean and median age of trauma by year



The mean and median age of trauma patients who died was around 55 years in 2004. This increasing trend in age at death reflects an aging population, with more trauma deaths occurring among the very old due primarily to falls. Age is an independent predictor of mortality in trauma patients, due in part to the presence of co-morbidities (e.g., diabetes, heart disease) that are more common in older patients.

Table 3a. Mean and median of age of trauma deaths by year

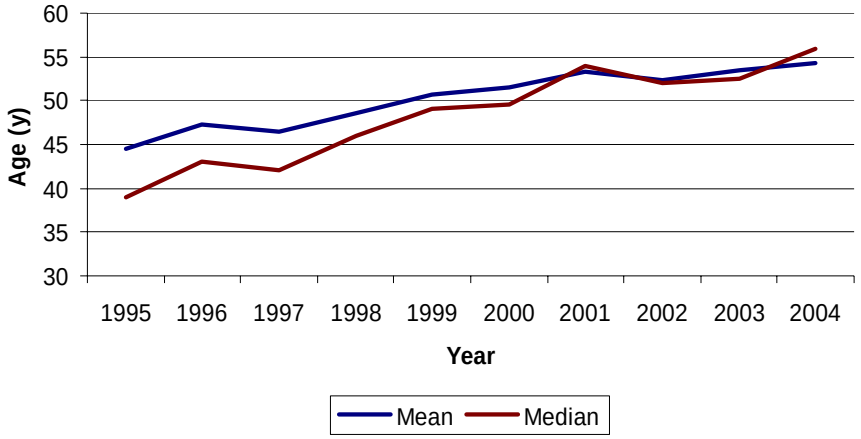
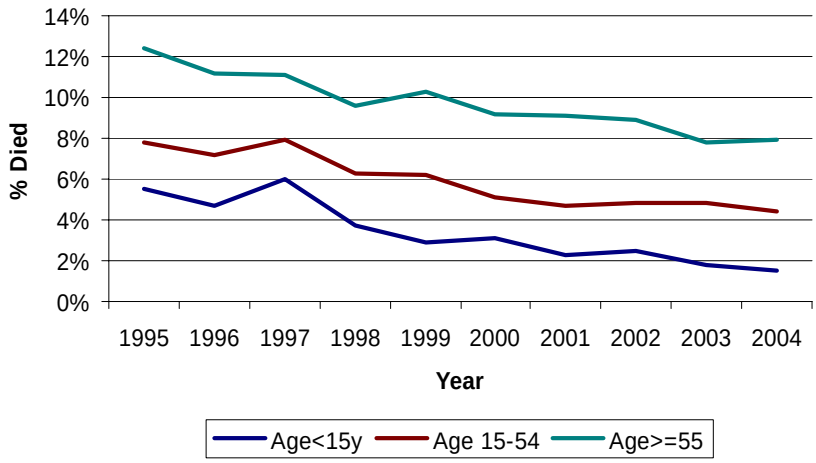
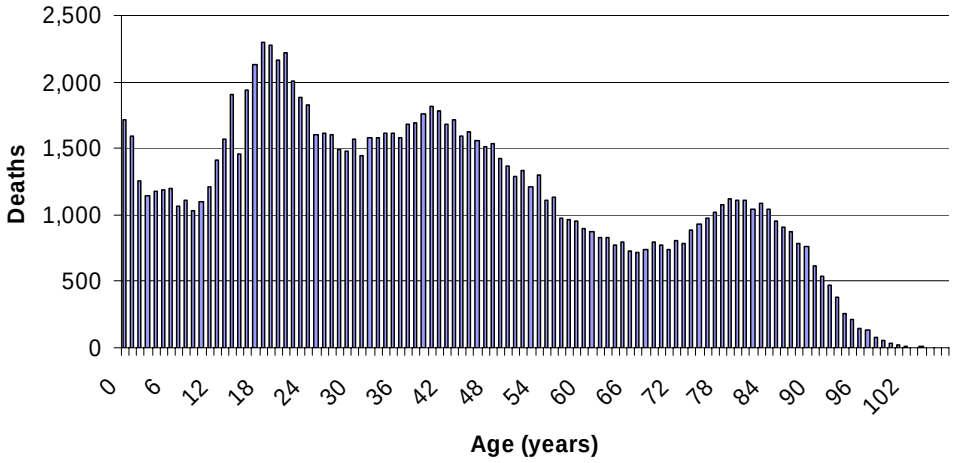


Table 3b. In-hospital mortality by age and year



The pattern of trauma deaths is predictable, with first peak among infants. Deaths decline until the early teen years then climb steadily through age 18 years. Overall, the greatest concentration of deaths occurs in teenagers and young adults between the ages of 15 and 24. After this age, deaths remain relatively steady until age 40 when a decline begins. By age 70, deaths begin to increase due primarily to fall mechanisms. For trauma patients age 70 or older, more than 75% of trauma deaths are attributable to falls.

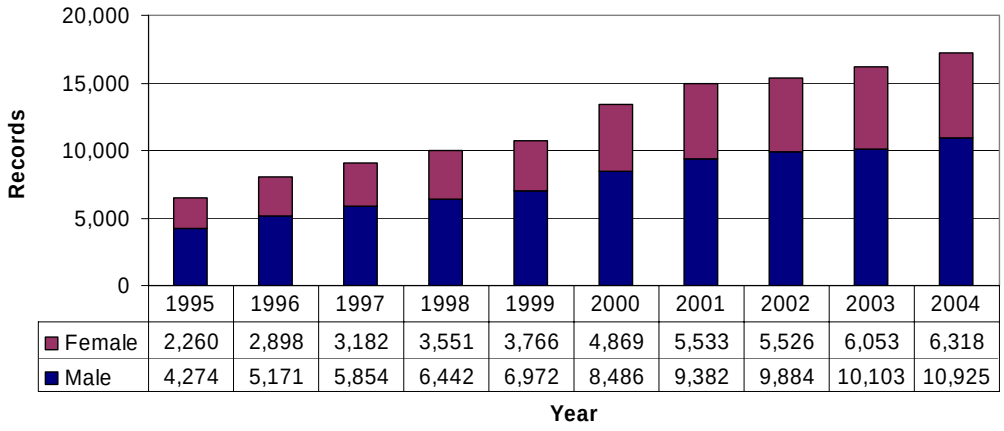
Table 4. Frequency of trauma deaths by age, 1995-2004



Gender

Men represent a greater share of the trauma volume than do women, with nearly 2/3 of trauma occurring among males. Seventy percent of trauma in people under 65 years of age occurs among men, while in people ages 65 and older, males represent 40% of trauma.

Table 5. Trauma volume by gender and year

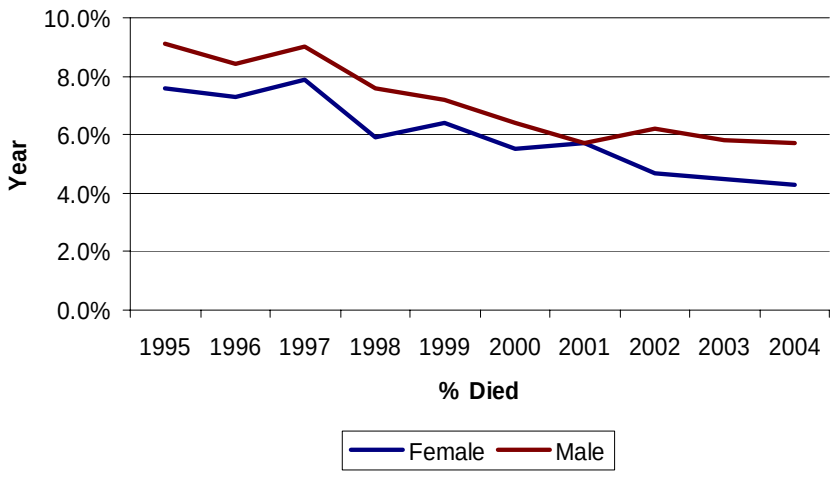


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Female	2,260	2,898	3,182	3,551	3,766	4,869	5,533	5,526	6,053	6,318
Male	4,274	5,171	5,854	6,442	6,972	8,486	9,382	9,884	10,103	10,925

Year

The proportion of men who die is greater than for women, and this trend has continued over the past ten years.

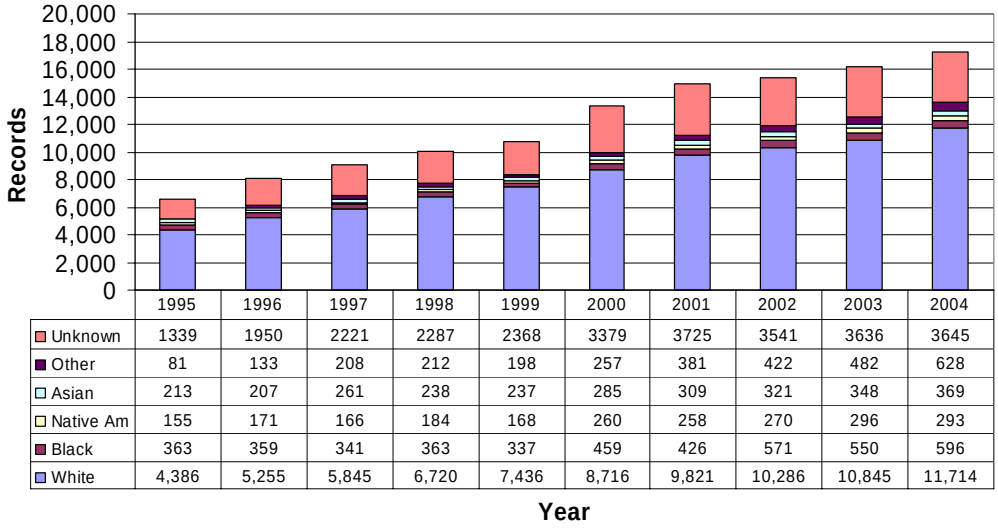
Table 6. In-hospital mortality by gender and year



Race

Patient race remains difficult to collect, with about 21 percent of records missing race data in 2004. Race data are missing from some hospitals more than others, with more than 90% of records missing race from 17 hospitals.

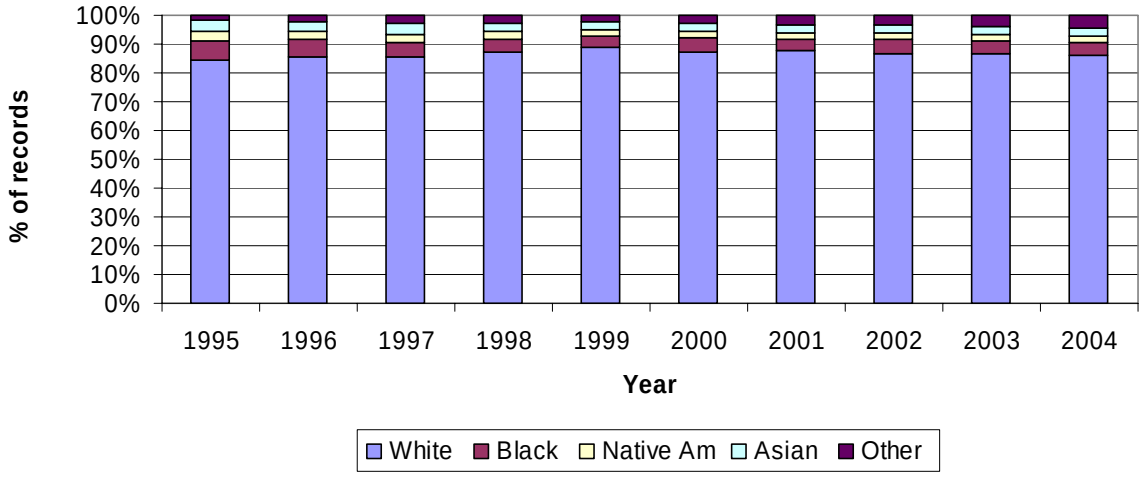
Table 7. Race of trauma by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Unknown	1339	1950	2221	2287	2368	3379	3725	3541	3636	3645
Other	81	133	208	212	198	257	381	422	482	628
Asian	213	207	261	238	237	285	309	321	348	369
Native Am	155	171	166	184	168	260	258	270	296	293
Black	363	359	341	363	337	459	426	571	550	596
White	4,386	5,255	5,845	6,720	7,436	8,716	9,821	10,286	10,845	11,714

For records with race data included, whites comprise about 86% of trauma. Overall in 2004, Blacks accounted for 4.4% of all trauma, but 7.2% of self-inflicted trauma and 16.7% of interpersonal trauma.

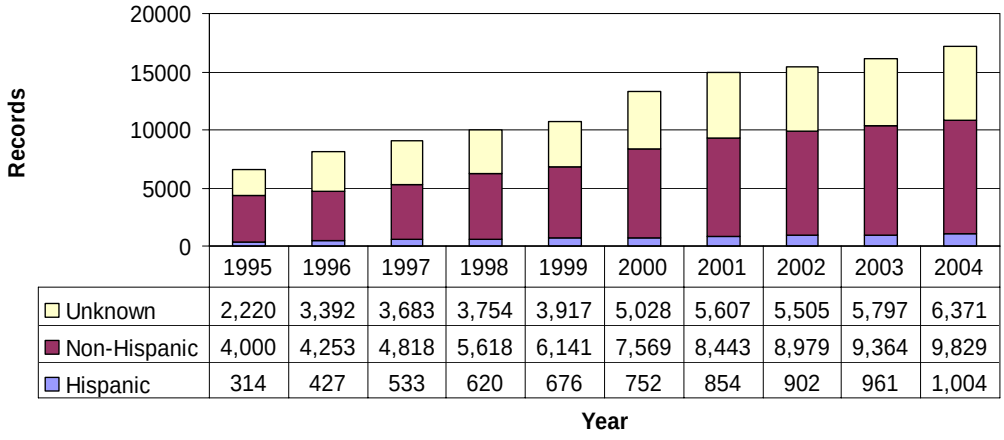
Table 8. Race of trauma patients by year (excluding cases with missing race data)



Ethnicity

Similar to race, capturing ethnicity data remains a challenge for the trauma registry. In 2004, about 37% of records were missing ethnicity. Ethnicity data are missing in more than 90% of records from 19 hospitals.

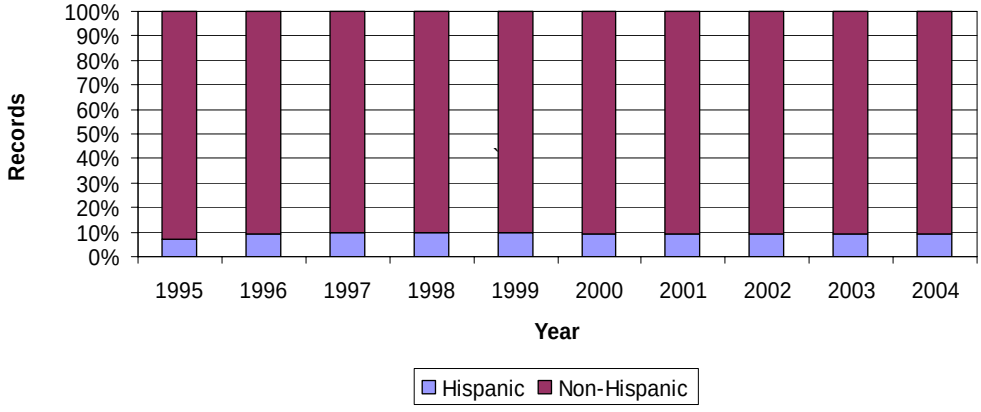
Table 9. Ethnicity of trauma patients by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Unknown	2,220	3,392	3,683	3,754	3,917	5,028	5,607	5,505	5,797	6,371
Non-Hispanic	4,000	4,253	4,818	5,618	6,141	7,569	8,443	8,979	9,364	9,829
Hispanic	314	427	533	620	676	752	854	902	961	1,004

When ethnicity data are available in the record, Hispanic people represent 10% of trauma. However, Hispanics represent 8.4% of unintentional trauma, but 18.8% of interpersonal trauma.

Table 10. Ethnicity of trauma patients by year (excluding cases with missing ethnicity data)



Preexisting Conditions/Co-morbidities

More than half of trauma patients have one or more preexisting conditions that may increase the likelihood of death from injury. One out of seven (14%) trauma patients brings three or more preexisting conditions with them to the hospital.

Table 11. Mean number of preexisting conditions per patient, 2004

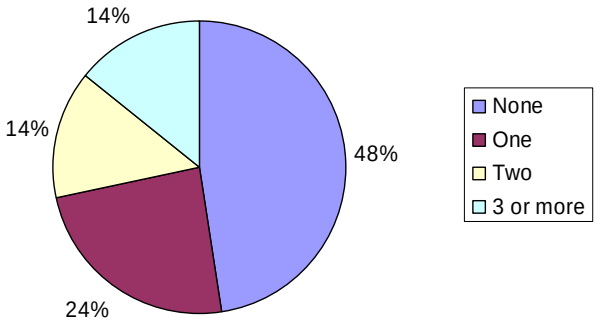
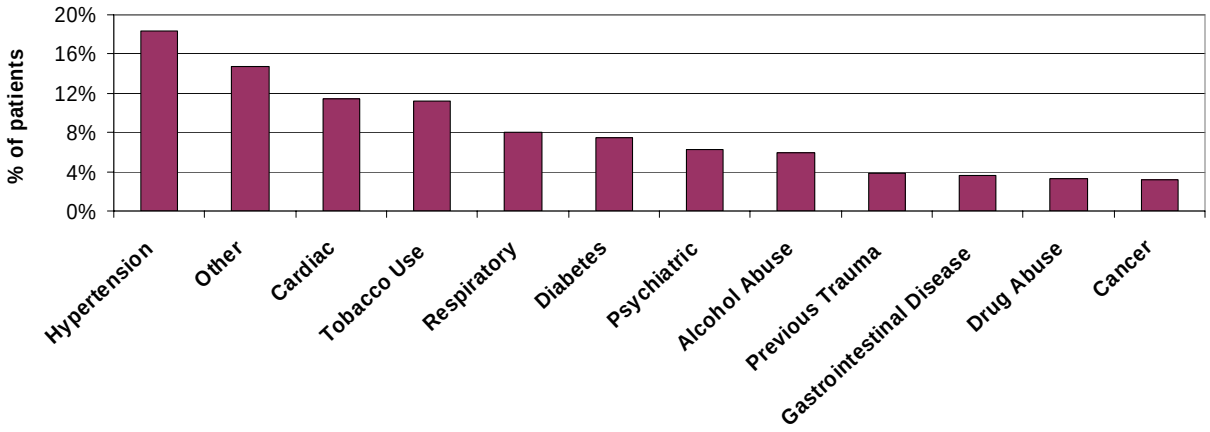


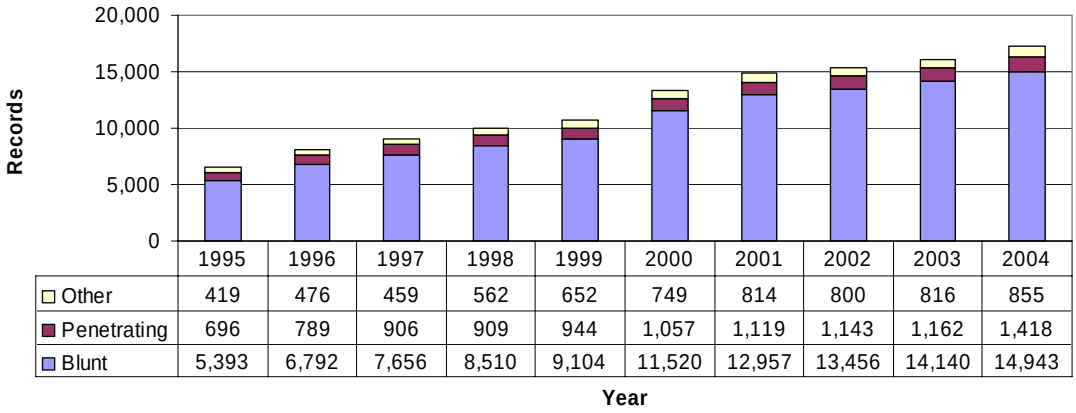
Table 12. Most commonly reported preexisting conditions, 2004



Injury Type

Blunt trauma is much more common in Washington State than is penetrating trauma. In 2004, trauma cases were classified as 86.7% blunt force, 8.2% penetrating, and 5.1% other such as drowning, suffocation, or burns. Falls are the leading causes of trauma in the registry with 42.2% of cases attributable to some type of fall in 2004. Falls include a wide spectrum of types from baby-walker falls in infants to ground-level falls in the elderly. Motor vehicle crashes are the second leading cause of trauma, representing 16.9% of cases.

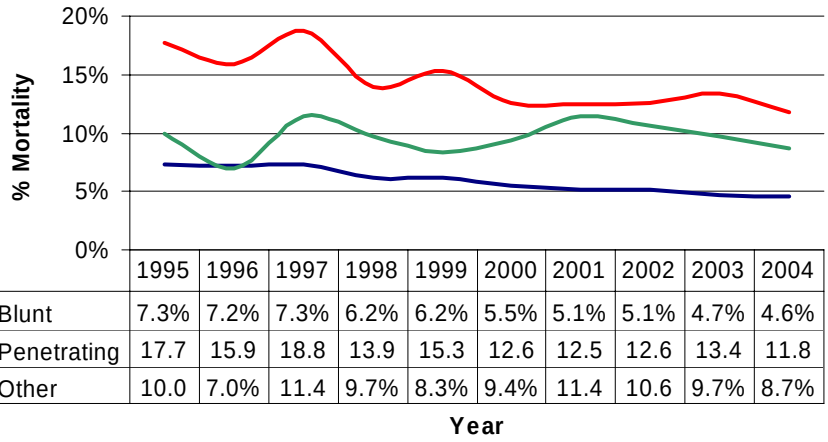
Table 13. Injury type by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Other	419	476	459	562	652	749	814	800	816	855
Penetrating	696	789	906	909	944	1,057	1,119	1,143	1,162	1,418
Blunt	5,393	6,792	7,656	8,510	9,104	11,520	12,957	13,456	14,140	14,943

In-hospital mortality for penetrating trauma is greater than for blunt or other types of trauma. A decreasing trend in mortality is observable for penetrating and blunt trauma during the first ten years of the trauma system. The 'other' injury category includes a mix of injury mechanisms such as burns, drowning, asphyxiation, and electrocution, and mortality has remained relatively stable during this period.

Table 14. In-hospital mortality by injury type and year

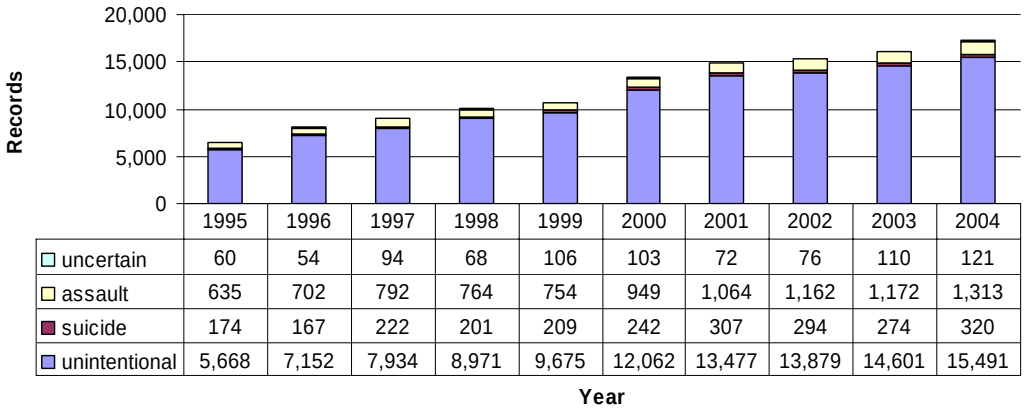


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Blunt	7.3%	7.2%	7.3%	6.2%	6.2%	5.5%	5.1%	5.1%	4.7%	4.6%
Penetrating	17.7	15.9	18.8	13.9	15.3	12.6	12.5	12.6	13.4	11.8
Other	10.0	7.0%	11.4	9.7%	8.3%	9.4%	11.4	10.6	9.7%	8.7%

Intent

In Washington State, 90% of trauma is unintentional in nature. Assault and self-inflicted injuries account for about 9.3%. In the remaining cases, intent could not be determined.

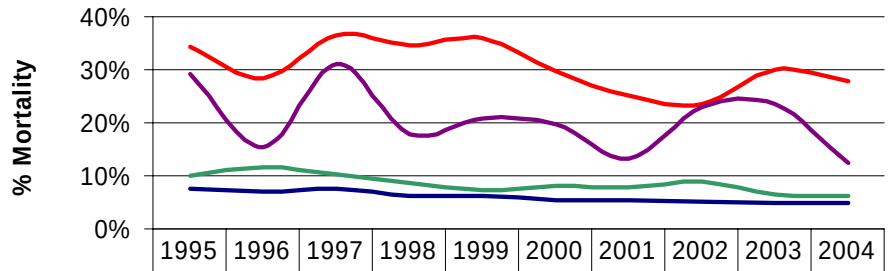
Table 15a. Intent of Injury



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
uncertain	60	54	94	68	106	103	72	76	110	121
assault	635	702	792	764	754	949	1,064	1,162	1,172	1,313
suicide	174	167	222	201	209	242	307	294	274	320
unintentional	5,668	7,152	7,934	8,971	9,675	12,062	13,477	13,879	14,601	15,491

Mortality is related to intent of injury, with the greatest mortality among trauma patients with self-inflicted injuries (i.e., suicide attempts). About 95% of patients with unintentional injuries survive, compared to less than 75% of patients with self-inflicted injuries. Nearly 94% of assault victims survive, although gunshot victims have a worse survival rate than other types of assault such as knives.

Table 15b. In-hospital mortality by intent and year

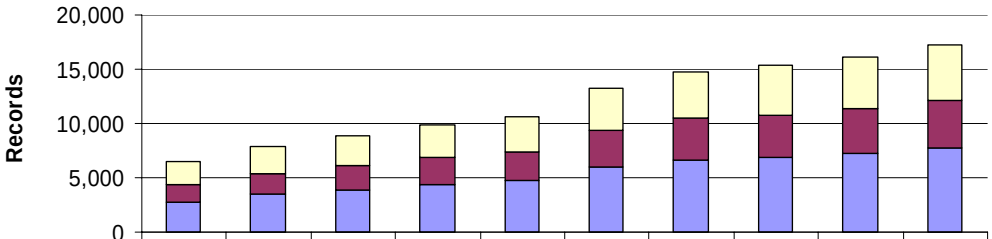


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
unintentional	7.5%	7.1%	7.5%	6.2%	6.3%	5.5%	5.3%	5.2%	4.8%	4.8%
self-inflicted	34.4	28.5	36.6	34.5	35.9	29.6	25.2	23.4	30.1	27.9
assault	9.9%	11.6	10.2	8.6%	7.4%	8.0%	7.9%	8.8%	6.5%	6.3%
uncertain	29.2	15.4	31.1	17.9	20.8	19.6	13.3	23.1	23.5	12.5

Time and Day of Injury

Less than half (44%) of trauma cases arrive at the hospitals during the day (i.e., 7:00 AM – 5:00 PM), with about 30% arriving between 11:00 PM and 7:00 AM. Trauma centers must be ready and available at any time of day.

Table 16. Time of trauma patient arrival at hospital by year

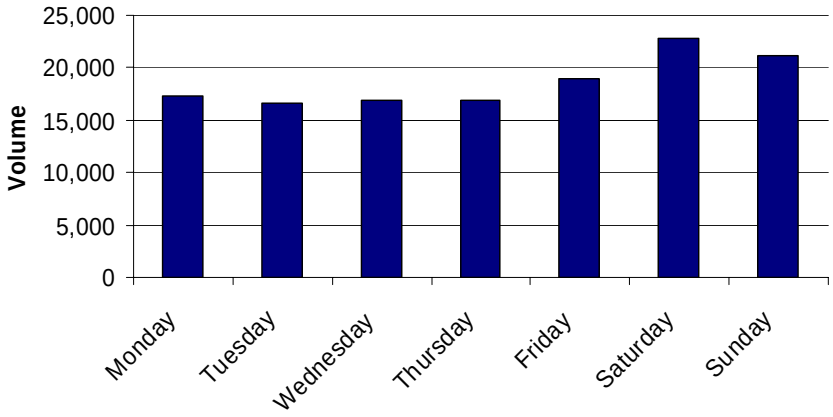


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
11:00 PM - 6:59 AM	2,060	2,531	2,806	3,008	3,227	3,796	4,341	4,632	4,776	5,089
5:00 PM - 10:59 PM	1,587	1,965	2,222	2,422	2,579	3,379	3,808	3,866	4,110	4,400
7:00 AM to 4:59 PM	2,801	3,438	3,858	4,433	4,811	6,015	6,651	6,830	7,221	7,727

Year

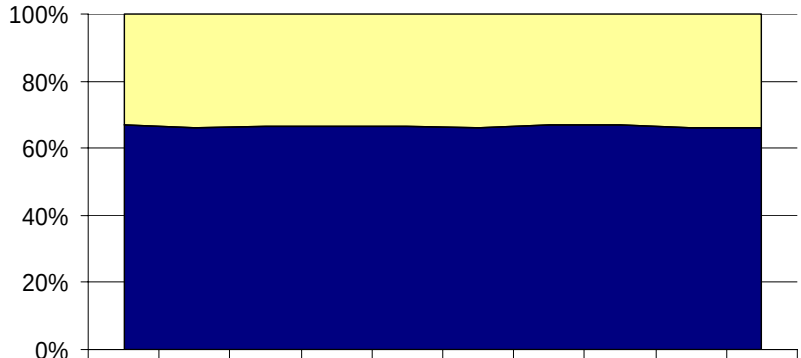
Saturday is the busiest day for trauma, followed closely by Sunday. Trauma is more likely to occur on a weekend days than on weekdays, with over 33% of trauma occurs on weekends.

Table 17. Trauma volume by day of week
1995-2004



The pattern of trauma by day of week has remained unchanged over the past 10 years. Injury day of week is not associated with mortality, providing evidence of consistent readiness on the part of Washington's trauma system.

Table 18. Trauma volume by day of week and year

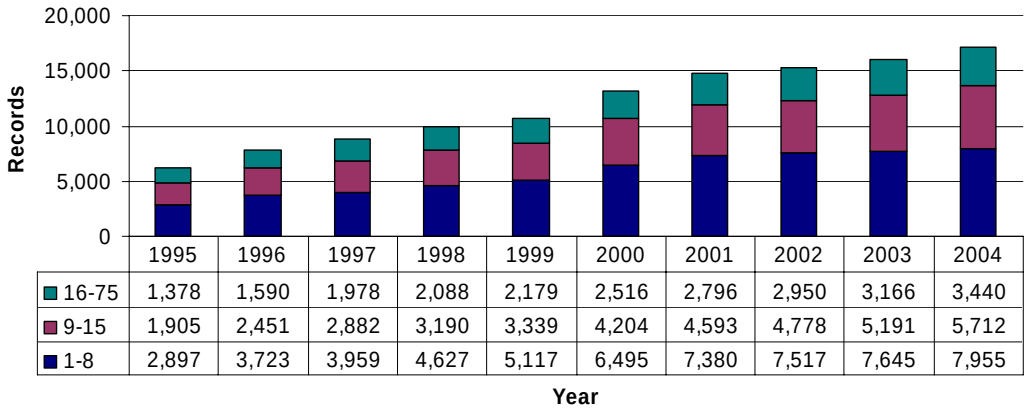


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Weekend	2,161	2,754	3,041	3,335	3,602	4,545	4,903	5,087	5,470	5,842
Weekday	4,376	5,321	6,001	6,669	7,142	8,811	10,017	10,324	10,687	11,403

Injury Severity

About 20% of trauma is categorized as major with an Injury Severity Score[1] (ISS) of greater or equal to 16. Nearly half of the trauma registry cases are low acuity, with an ISS of less than 9.

Table 19. Trauma volume by Injury Severity Score and year

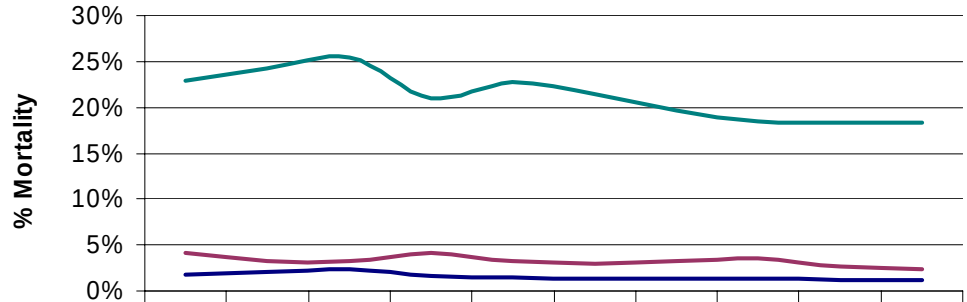


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
16-75	1,378	1,590	1,978	2,088	2,179	2,516	2,796	2,950	3,166	3,440
9-15	1,905	2,451	2,882	3,190	3,339	4,204	4,593	4,778	5,191	5,712
1-8	2,897	3,723	3,959	4,627	5,117	6,495	7,380	7,517	7,645	7,955

Year

Mortality is strongly related to severity of injury. Nearly 99% of patients with low acuity injuries survive compared to about 82% of patients with major trauma.

Table 20. In-hospital mortality by Injury Severity Score and year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0-8	1.8%	2.0%	2.3%	1.6%	1.5%	1.3%	1.3%	1.3%	1.2%	1.2%
9-15	4.2%	3.3%	3.3%	4.1%	3.3%	3.0%	3.3%	3.5%	2.7%	2.4%
16-75	22.9%	24.2%	25.4%	21.0%	22.7%	21.4%	19.7%	18.5%	18.3%	18.3%

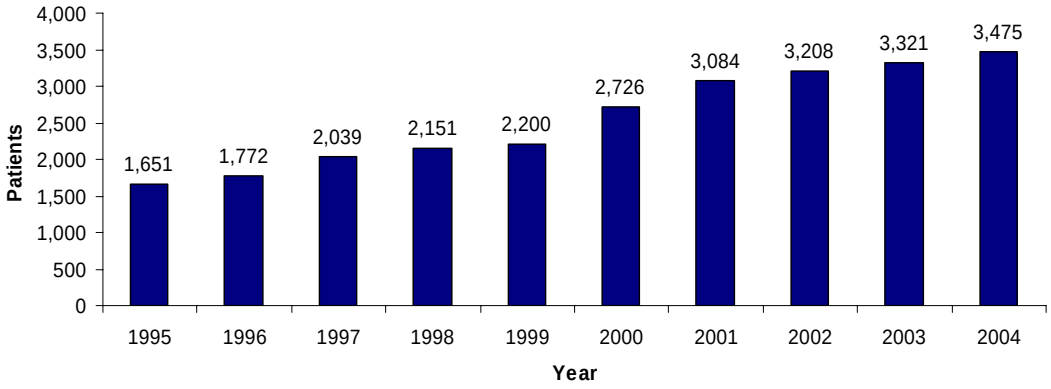
Year

[1] The Injury Severity Score is a summary score for traumatic injuries. The ISS is calculated as the square of the Abbreviated Injury Scores (AIS). If a patient has more than one AIS, the highest AIS value is selected from each of up to six body regions (head/neck, face, thorax, abdominal and pelvic contents, limbs and skin) and the three highest of these are squared and summed. If any AIS score is 6, then the ISS is set at 75. Values range from 1 (minor) to 75 (almost always fatal).

Traumatic Brain Injury (TBI)

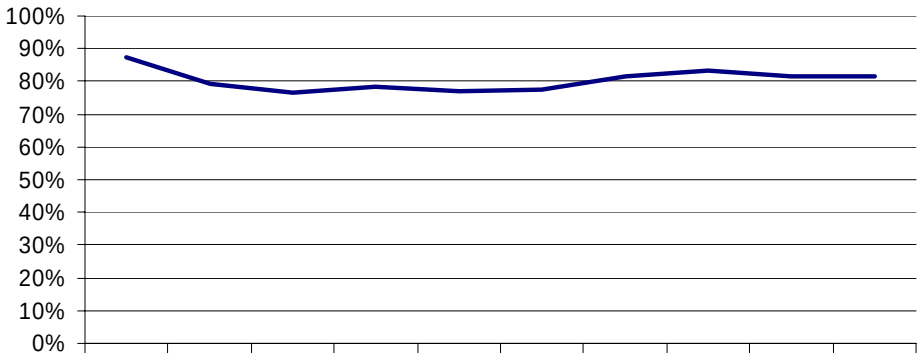
In 2004, 4,646 records include a diagnosis of traumatic brain injury. Of these, 1,015 patients were transferred to another acute care facility, including 936 (92.2%) that were transferred to a level I or II trauma center.

Table 21. Patients with traumatic brain injury by year



Level I and II trauma services are required to have neurosurgical services available to the patient on a 24 hour/7 day per week basis. In 2004, 81.7% of admitted TBI patients received care at a level I or II hospital. Some level III hospitals have neurosurgical resources and do admit patients with traumatic brain injuries.

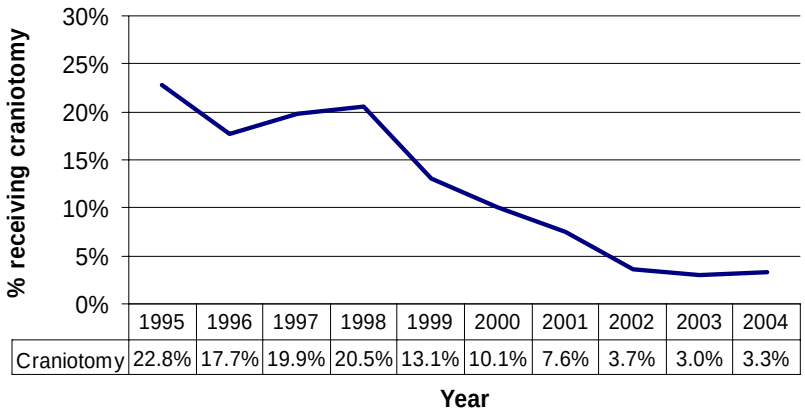
Table 22. Proportion of TBI patients receiving definitive care at a level I or II trauma service by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Level I or II	87.3%	79.1%	76.7%	78.4%	76.8%	77.5%	81.6%	83.3%	81.7%	81.7%

Treatment for patients with traumatic brain injury is shifting away from surgical management. More than 22% of admitted TBI patients received a craniotomy in 1995, compared to 3.2% in 2004.

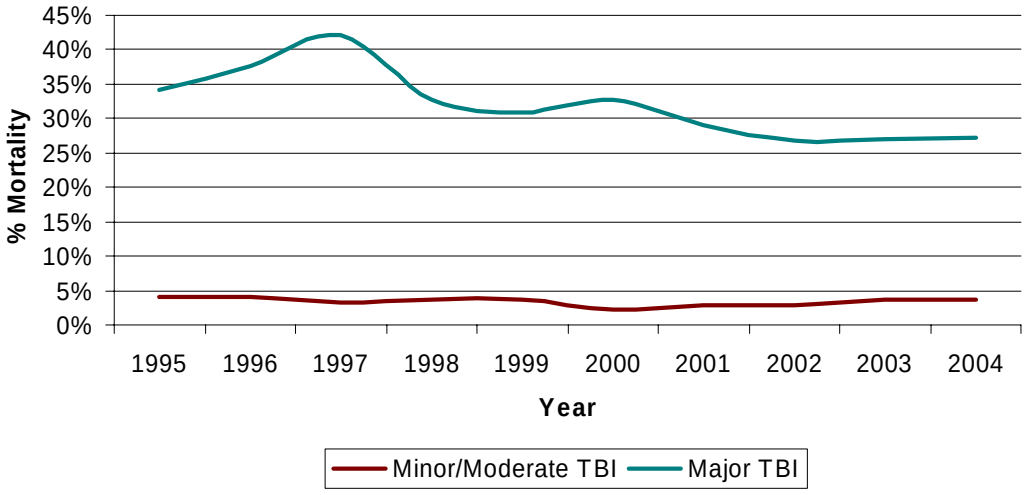
Table 23. Proportion of admitted TBI patients who undergo a craniotomy by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Craniotomy	22.8%	17.7%	19.9%	20.5%	13.1%	10.1%	7.6%	3.7%	3.0%	3.3%

Over the same period, mortality for TBI patients has declined from 15.5% in 1995 to 12.5% in 2004. However, mortality is strongly related to severity of brain injury. Mortality has remained stable and very low for patients with minor or moderate traumatic brain injury, with less than 5% of patients dying. Much of the improvement in survival has occurred among patients with major traumatic brain injury where mortality has declined from 34.2% in 1995 to 27.1% in 2004.

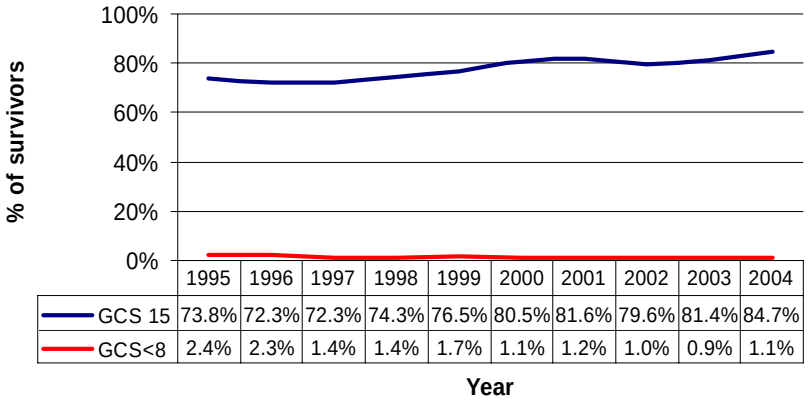
Table 24. In-hospital mortality for TBI patients by year



Note: Major traumatic brain injury is defined by the presence of one or more Abbreviated Injury Score (AIS) of 4 or greater to the head region. Minor/moderate TBI is defined by a maximum AIS score of 3 to the head region.

Disability for patients who survive a traumatic brain injury is an important outcome measure. The Glasgow Coma Score (GCS) is a widely used index that assesses the degree of coma in patients with brain injuries. A GCS of 15 is considered normal (no deficit), while a GCS of less than 8 is considered a severe deficit. More than 80% of survivors with TBI are discharged without cognitive impairment (i.e., GCS of 15). Conversely, about 1% of survivors have very significant cognitive impairment, with a GCS of less than 8.

Table 25. TBI survivors by Glasgow Coma Score at discharge and year

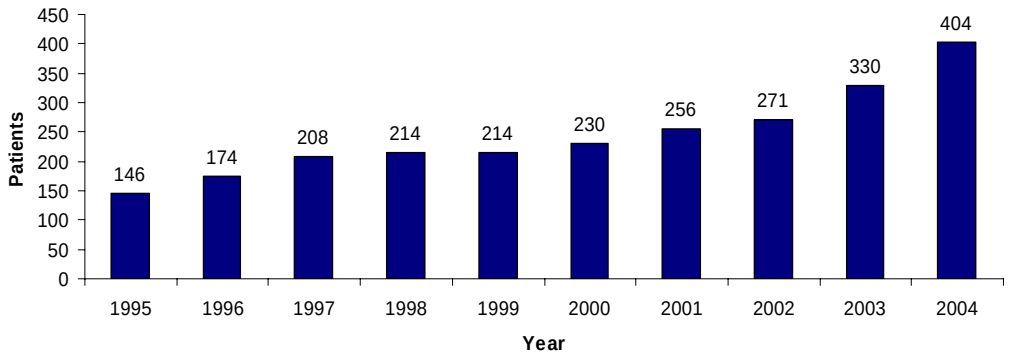


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
GCS 15	73.8%	72.3%	72.3%	74.3%	76.5%	80.5%	81.6%	79.6%	81.4%	84.7%
GCS<8	2.4%	2.3%	1.4%	1.4%	1.7%	1.1%	1.2%	1.0%	0.9%	1.1%

Spinal Cord Injury

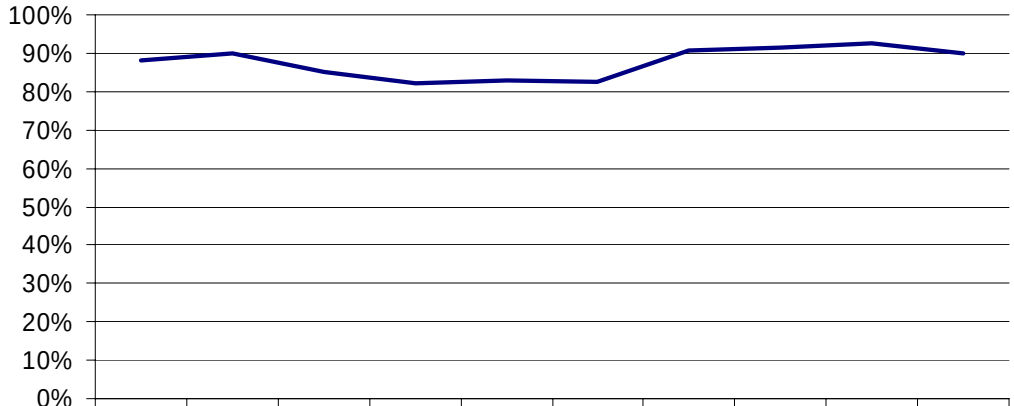
In 2004, 404 individuals experienced a spinal cord injury significant enough to meet the trauma registry inclusion criteria. Of these, 48 (11.9%) died.

Table 26. Patients with spinal cord injury by year



Most patients with spinal cord injuries receive definitive care at either a level I or level II trauma service.

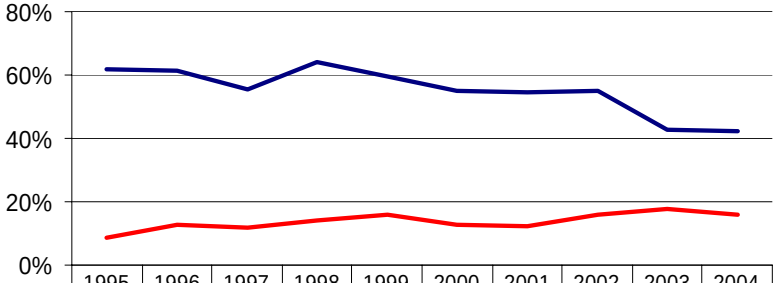
Table 27. Proportion of patients with spinal cord injury receiving definitive care at a level I or II trauma service by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Level I or II	88.1%	90.1%	85.2%	82.1%	82.8%	82.6%	90.8%	91.3%	92.7%	90.0%

While over 60% of SCI survivors were discharged to a rehabilitation service in 1995, 42.3% were discharged to a rehabilitation service in 2004. Part of this decline is due to more discharges to home, but discharges to skilled nursing facilities have increased during this time period, perhaps indicating increasing difficulty accessing rehabilitation services.

Table 28. Proportion of SCI survivors discharged to a rehabilitation service by year



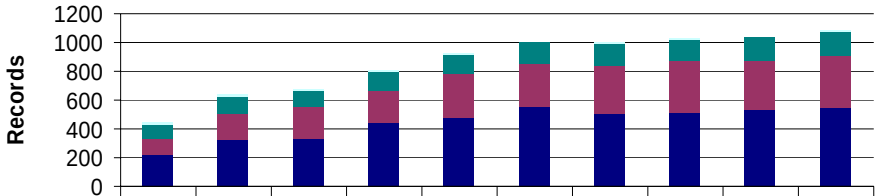
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Rehab	61.9%	61.5%	55.3%	64.0%	59.6%	55.1%	54.6%	55.2%	42.8%	42.3%
SNF	8.5%	12.9%	11.8%	13.9%	15.8%	12.8%	12.2%	15.9%	17.8%	16.0%

Year

Occupational trauma

About 7% of trauma is work-related. Falls are the most common mechanism of injury accounting for 1/3 of all work-related traumas.

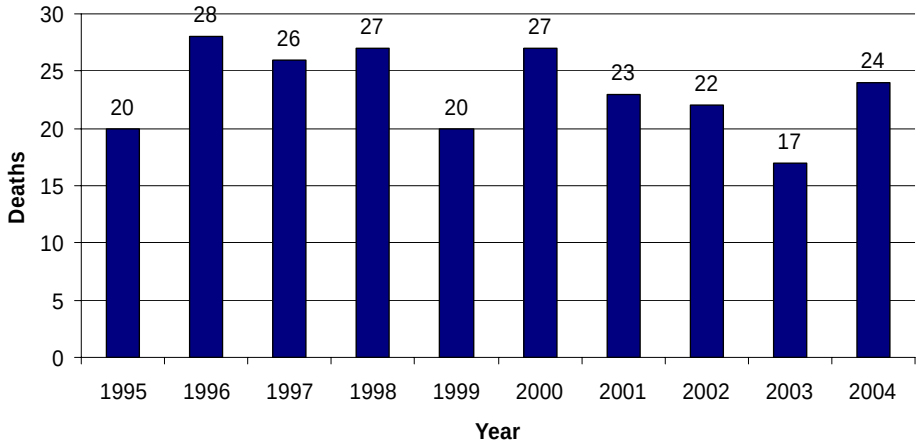
Table 29. Work-related trauma by Injury Severity Score and year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Missing	25	21	16	8	4	7	4	7	4	5
16-75	86	116	107	130	133	146	160	146	166	171
9-15	121	185	226	232	305	295	327	360	336	362
0-8	217	320	329	436	479	556	508	515	536	546

In 2004, there were 24 work-related deaths in the trauma registry, representing a mortality proportion of 2.8%.

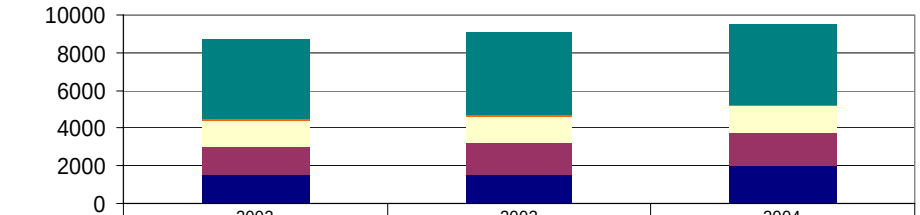
Table 30. Work-related trauma deaths by year



EMS

Data on EMS response area are missing for more than 44% of records. A commonly accepted definition for categorizing geographic response area is critically lacking. New developments in geographic information systems and electronic position should allow for better reporting of location data through the statewide EMS registry project, currently in development.

Table 31. EMS scene responses by area



	2002	2003	2004
Unknown	4225	4330	4228
Wilderness	78	91	85
Rural	1334	1355	1427
Suburban	1507	1742	1708
Urban	1535	1521	2024

Year

Transport mode from the scene of injury is well documented in the trauma registry, with nearly 99% reporting. About 65% of trauma patients arrived at hospitals by ground ambulance, with another 5% arriving by helicopter. The remaining 30% of patients arrived by private vehicle or other transport such as police.

Table 32. Transport Mode from Scene

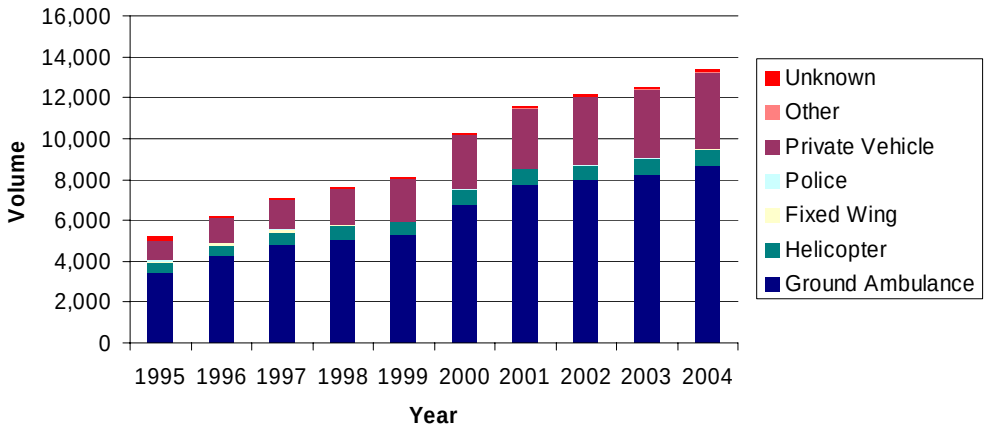
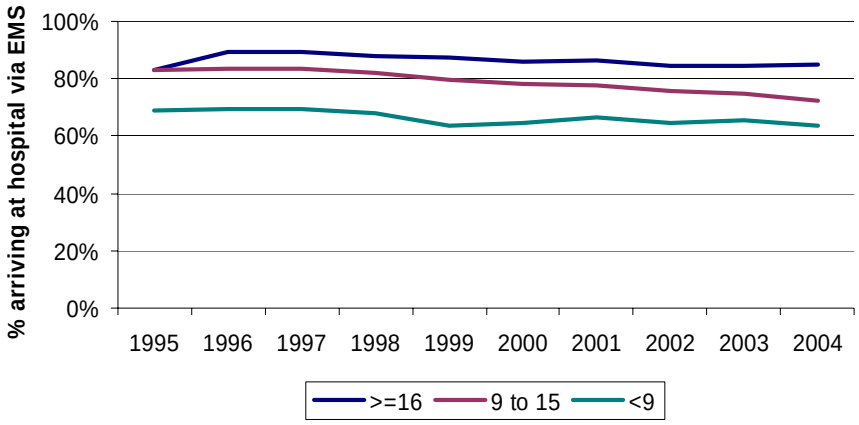
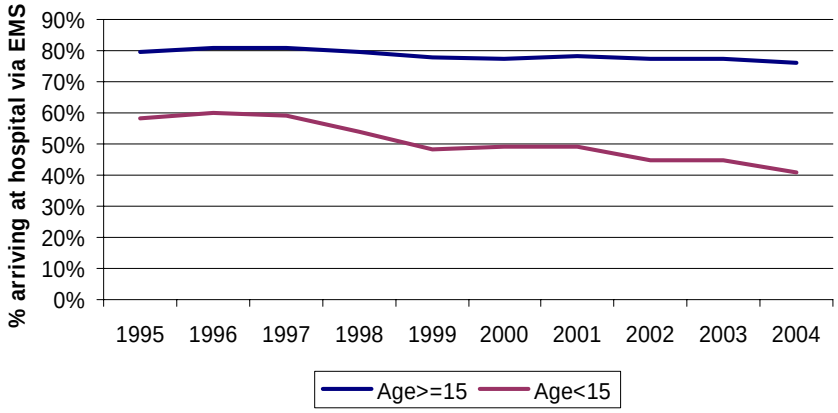


Table 33. Proportion of trauma patients arriving at hospital via EMS, by Injury Severity Score and year



At all levels of injury severity, children are less likely than adults to be transported to the hospital via EMS.

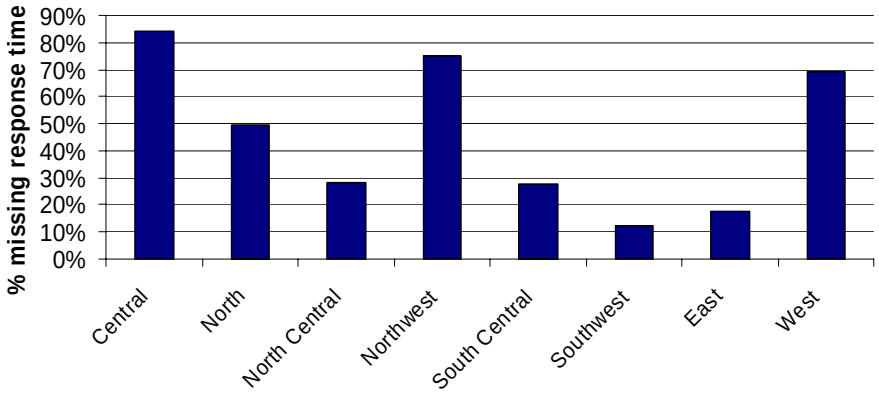
Table 34. Proportion of trauma patients arriving at hospital via EMS, by children vs. adults and year



EMS Response Times

Statewide, EMS response time data are missing for more than half of patients transported from the scene by EMS. Advances in computer-aided dispatch systems have resulted in fewer run report forms including time data. As such, hospitals often receive a run form with limited or no time data from EMS.

Table 35. Proportion of scene transports missing response time data by region, 2004



When available, EMS response times average around 11 minutes for the combined areas of urban, suburban, rural, wilderness.

Table 36. EMS Response Times (all areas)

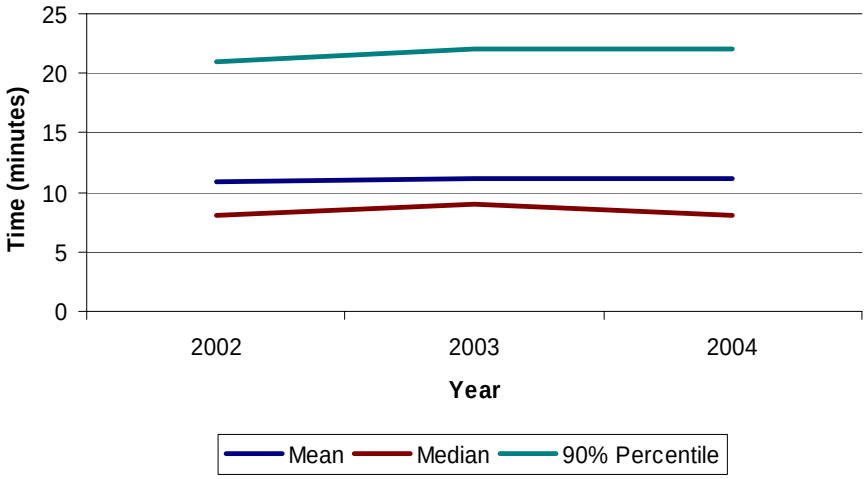
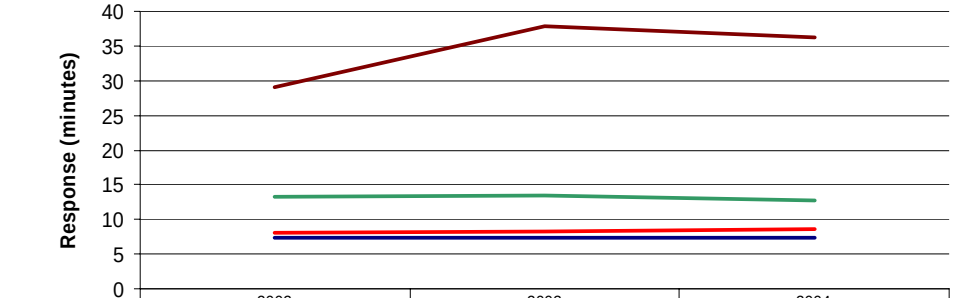


Table 37. Mean response time to scene by area type and year



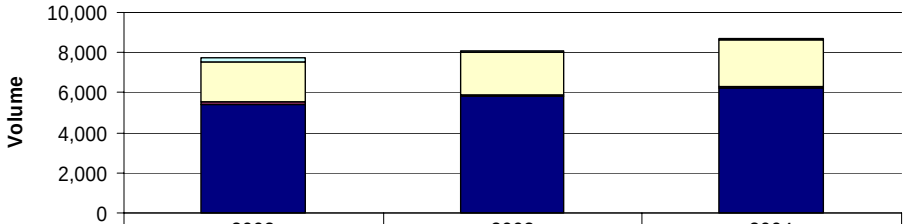
	2002	2003	2004
Urban	7.3	7.4	7.3
Suburban	8.1	8.3	8.6
Rural	13.2	13.4	12.8
Wilderness	29.1	37.8	36.2

Year

Level of EMS service from scene

In 2004, 71.9% of scene trauma transports received paramedic-level (advanced life support) care. For major trauma patients, 83.9% received ALS-level care.

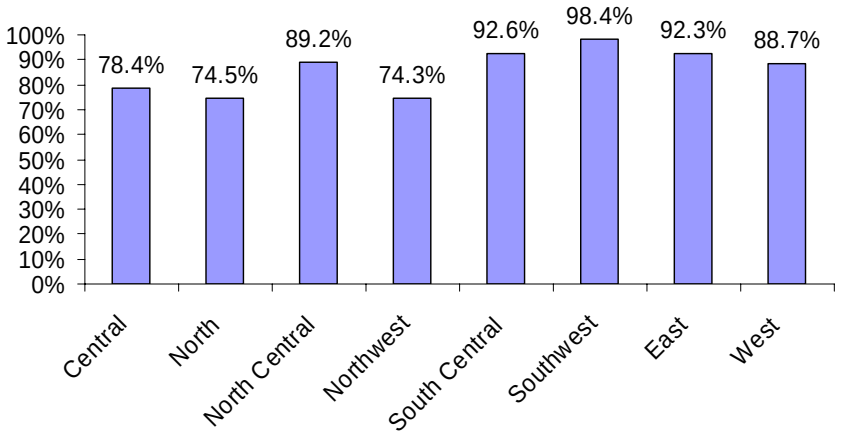
Table 38. Level of EMS service from scene by year



	2002	2003	2004
Unknown	187	59	62
BLS	2,007	2,091	2,325
ILS	77	67	53
ALS	5,439	5,850	6,233

Regional variation exists in the likelihood of receiving ALS care for major trauma patients, ranging from 74% in North and Northwest regions to nearly all (98.4%) in Southwest region.

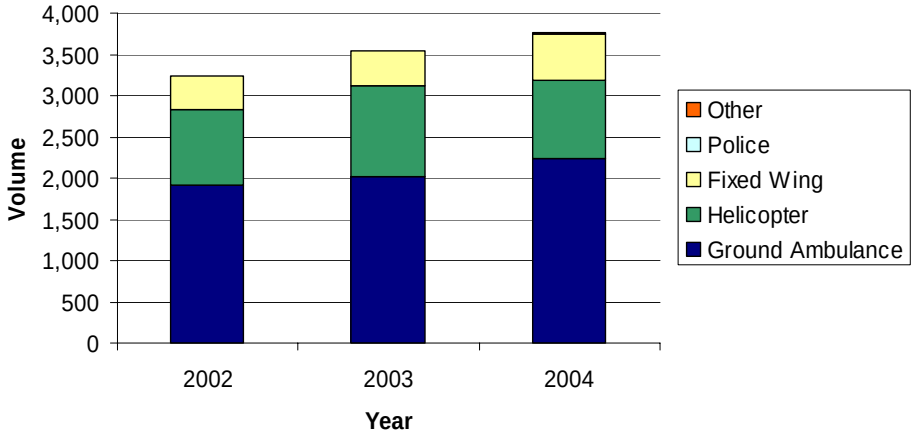
Table 39. Proportion of major trauma patients receiving ALS-level care by region, 2004



Interfacility Transport Mode

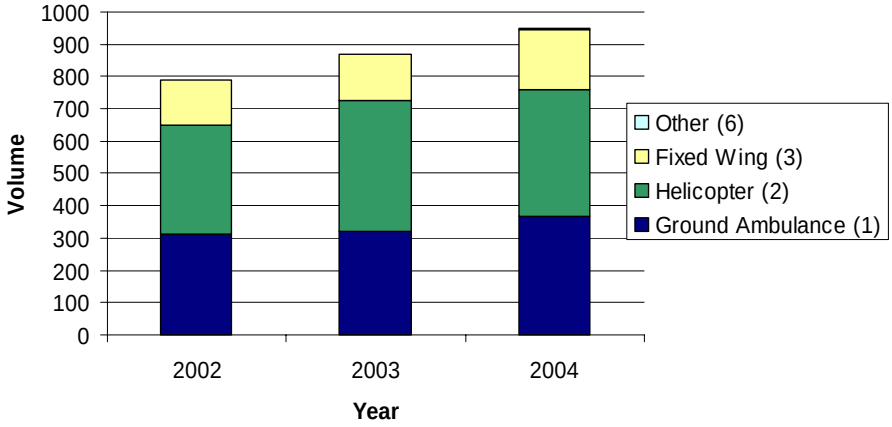
Air medical services are a major source of interfacility transportation for trauma patients. In 2004, 42.4% of transfers were flown by helicopter or fixed wing to a receiving hospital.

Table 40. Transport mode for interfacility transfers



However, for major trauma patients, more than 60 percent of transfers involve the use of air medical resources.

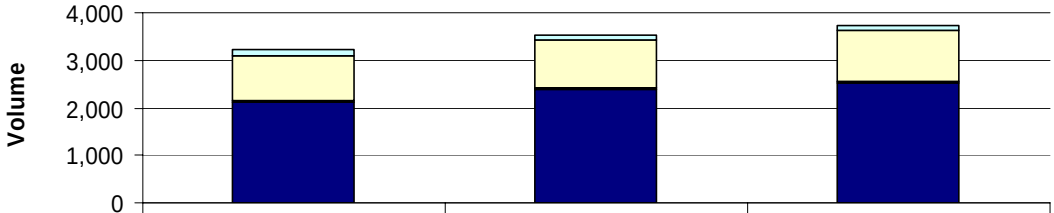
Table 41. Transport mode for interfacility transfers (major trauma patients only)



Level of EMS Service for Interfacility Transfers

More than 2/3 of interfacility transfers are performed by ALS-level personnel. For major trauma patients, more than 80% of transfers are performed by ALS personnel.

Table 42. Level of EMS Service for Interfacility Transfers by year

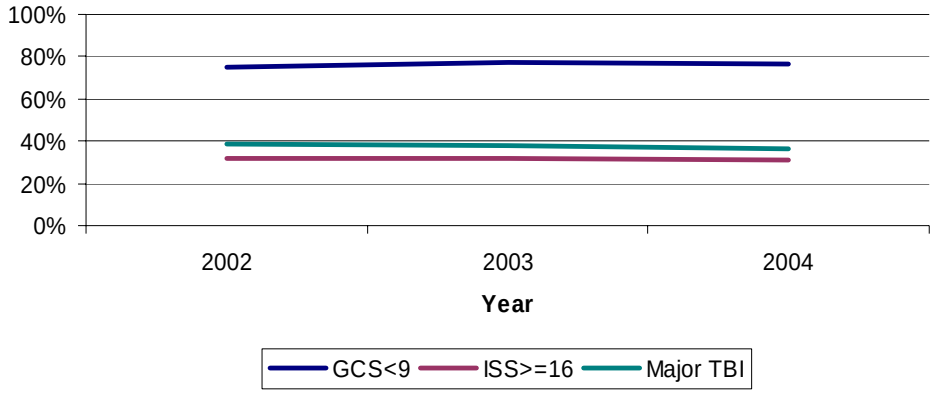


	2002	2003	2004
Unknown	127	108	128
BLS	961	1,029	1,067
ILS	18	34	24
ALS	2,130	2,373	2,528

Select field procedures performed

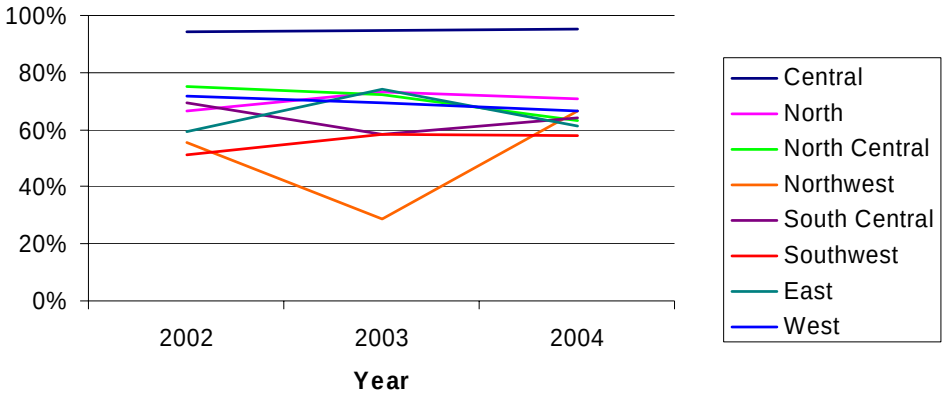
The use of endotracheal intubation varies by injury severity and level of service at the scene. Advanced life support personnel are trained to intubate patients in the field, whereas this procedure is beyond the training and scope of basic life support personnel. About 1/3 of major trauma patients transported from the scene receive an endotracheal intubation in the prehospital setting, although slightly more patients with major traumatic brain injury receive intubations. For patients with significant cognitive impact (i.e., Glasgow Coma Score of less than 9 at the scene), 3 out of 4 patients are intubated prior to arrival at the hospital.

Table 43. Proportion of select patient groups receiving endotracheal intubation in the field (all levels of service)



For ALS-level care of patients with a Glasgow Coma Score of less than 9 at the scene, the use of field intubation varies from about 95% in Central region to less than 60% in Northwest and Southwest regions.

Table 44. Proportion of patients with GCS<9 who receive intubations in the field by region (ALS personnel)



For patients with major traumatic brain injuries, intubation rates also vary significantly by region.

Table 45. Proportion of patients with major TBI who receive intubations in the field by region (ALS personnel)

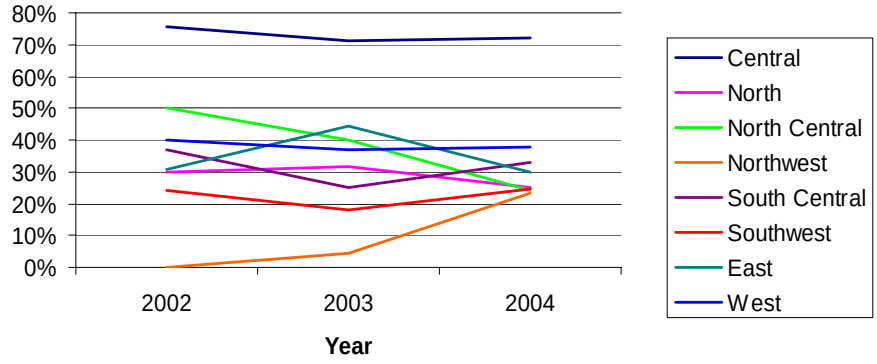
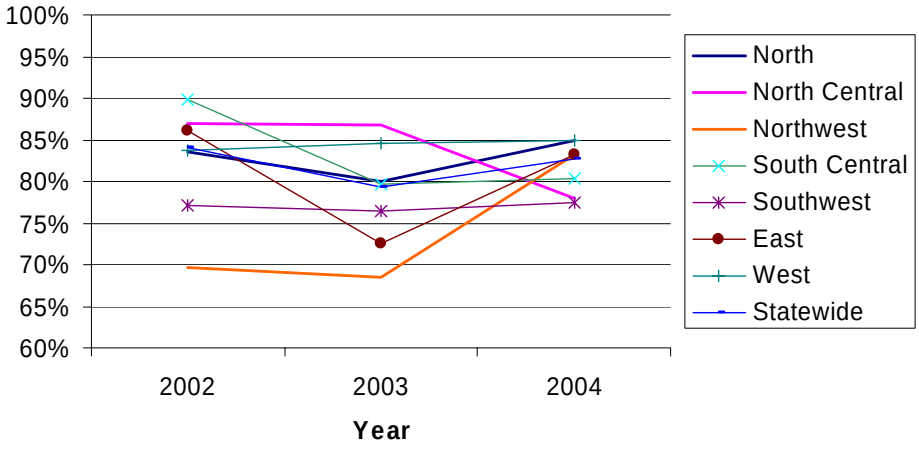


Table 46. Proportion of major trauma patients receiving an IV in the field by region (ALS transports only)



Scene Time

In 2004, the mean scene time for trauma patients who did not require extrication was 17 minutes. On average, extrication adds over 7 minutes to scene time.

Table 47. Scene Time (no extrication)

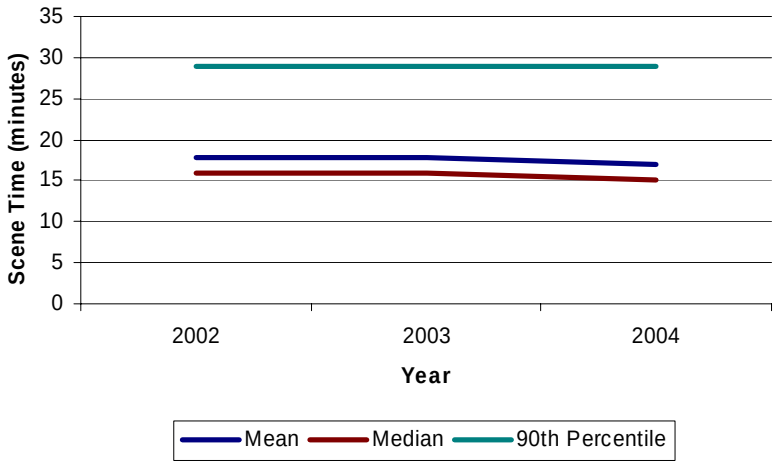
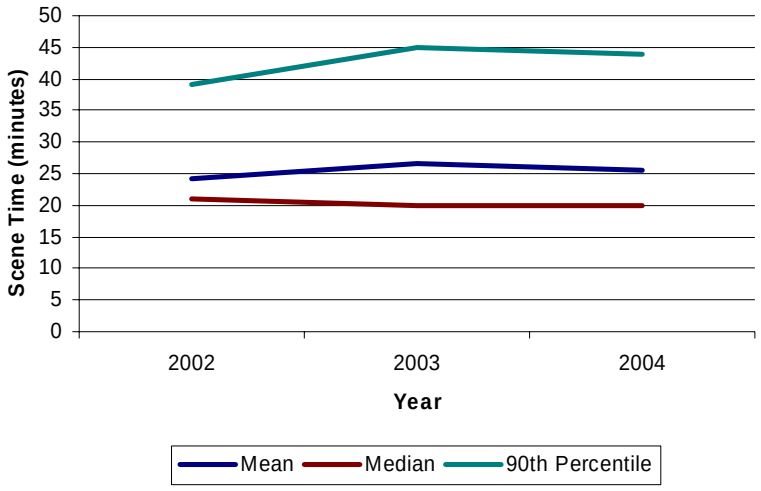


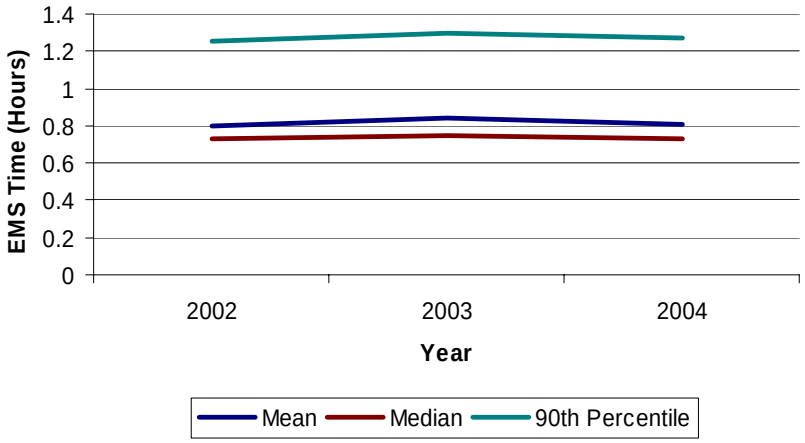
Table 48. Scene Time (with extrication)



The Golden Hour

Historically, the concept of the 'golden hour' has served as a foundation for organized trauma systems. The initial 60 minutes from time of injury to hospital care provides opportunity to prevent death in patients who would otherwise die due to lack of an airway and/or excessive blood loss.

Table 49. Time from EMS dispatch to arrival with patient at hospital

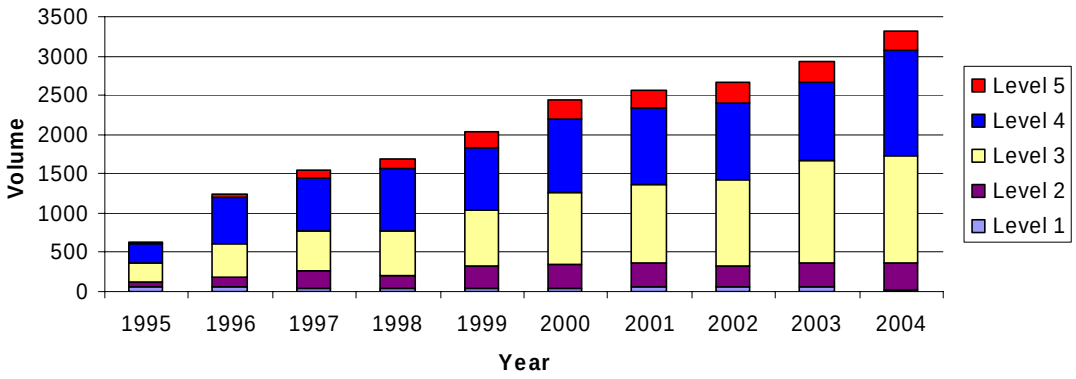


Definitive care

Interfacility transfers

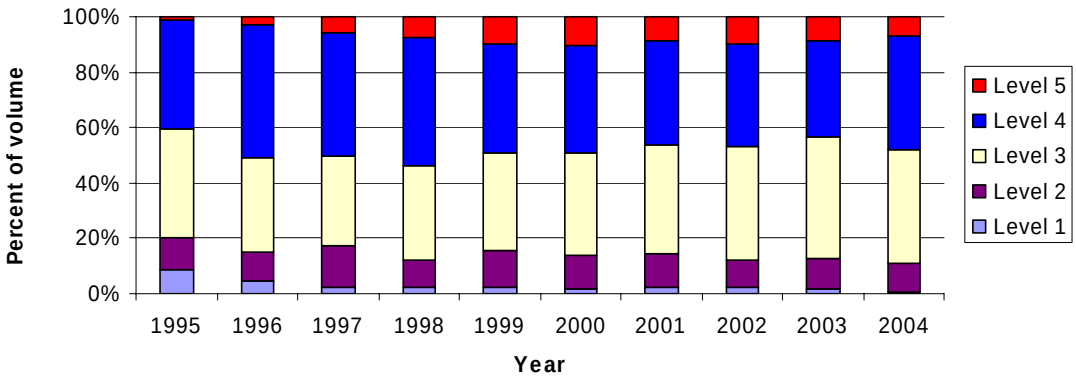
Washington's trauma system aims to assure that patients are transported to the highest level trauma service within 30 minutes. Often, the highest level facility is a small, rural hospital with trauma designation at the level IV or V. These initial receiving hospitals can provide resuscitation and stabilization prior to transfer to a higher level of care.

Table 50. Transfers to another acute care facility by sending hospital designation level and year



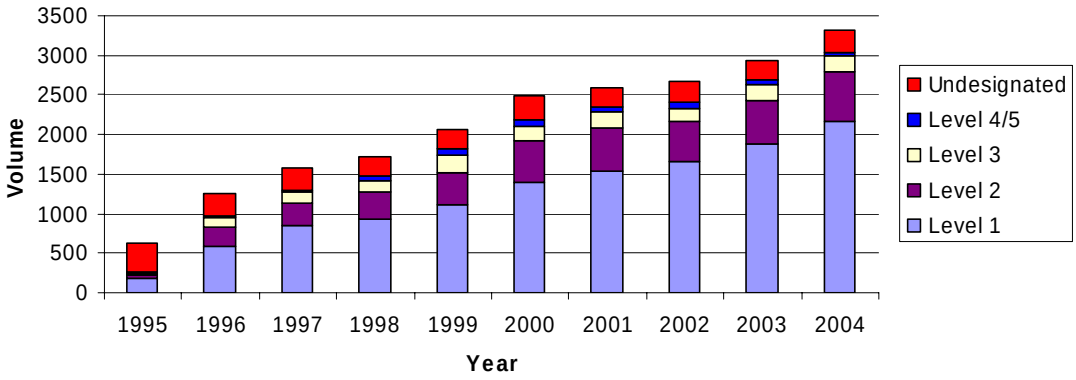
Level IV and V hospitals account for about half of all transfers within the trauma system. Level III hospitals are the source of about 40% of transfers, with a wide range of patients from severe multi-system trauma to relatively minor injuries with unique specialty needs.

Table 51. Transfers to another acute care facility by sending hospital designation level and year



About 65% of transferred patients are sent to a level I trauma service in either Seattle or Portland. About 20% of transferred patients are sent to one of Washington's level II trauma services. Level III hospitals typically receive few trauma patients in transfer. Hospitals without trauma designation sometimes receive transfers, but typically these are patients with relatively minor injuries who are transferred for manage care coverage reasons.

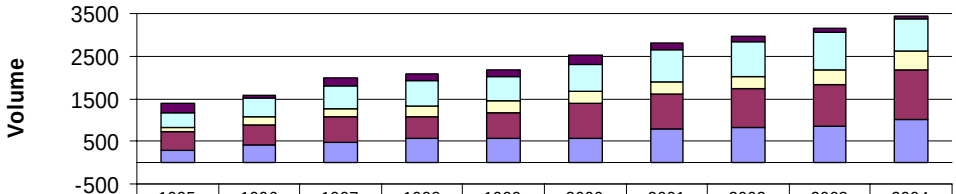
Table 52. Transfers to another acute care facility by receiving hospital designation level and year



Trauma team activation

Trauma patients may require immediate surgical intervention to establish an airway and/or control bleeding. The trauma system emphasizes the importance of early mobilization of trauma teams in order to assure that optimal resources reach the patient in the least amount of time. In 2004, 29.3% of major trauma patients received full trauma team activations that include the response of a trauma/general surgeon.

Table 53. Trauma team activation level for major trauma patients (ISS>=16)

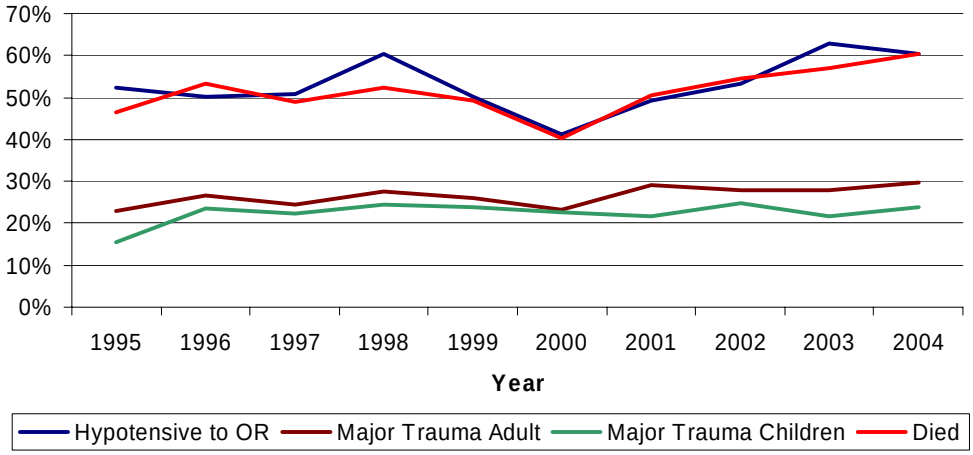


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Unknown	213	75	189	155	164	211	162	116	109	62
None	352	432	510	597	565	638	746	820	889	767
Trauma Consult	86	191	192	263	275	282	268	282	346	421
Modified Trauma Response	424	474	607	503	611	802	825	919	955	1,183
Full Trauma Response	303	418	480	570	564	583	795	813	867	1,007

Year

For hypotensive patients that required immediate surgical intervention, 61% received full trauma team activations in 2004.

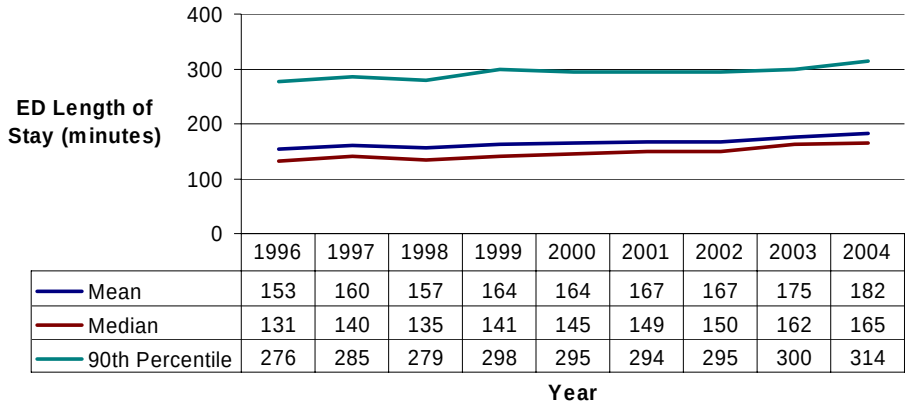
Table 54. Percent of selected groups receiving full trauma team activation by year



Time in the Emergency Department

The American College of Surgeons includes an audit filter to examine transfers out of the hospital occurring more than 6 hours after arrival in the emergency department. In Washington state, transfers generally occur much sooner than 6 hours, with an average of 3 hours to transfer in 2004.

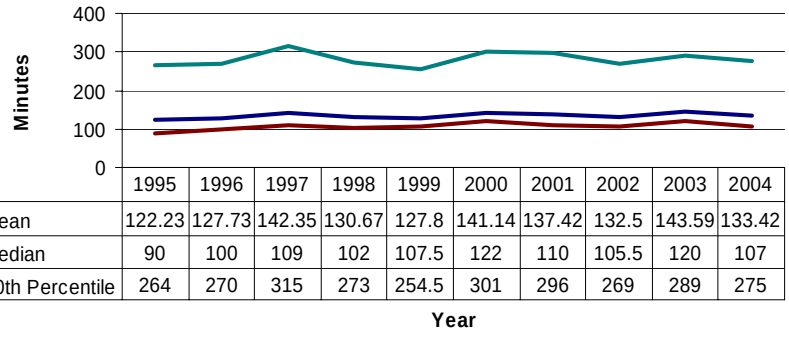
Table 55. Emergency department length of stay prior to transfer by year



	1996	1997	1998	1999	2000	2001	2002	2003	2004
Mean	153	160	157	164	164	167	167	175	182
Median	131	140	135	141	145	149	150	162	165
90th Percentile	276	285	279	298	295	294	295	300	314

For major trauma patients sent directly to the operating room from the emergency department, the average time in the emergency department was just over 2 hours in 2004. Ninety percent of these patients reach the operating room within about 4.5 hours.

Table 56. Time from arrival to operating room for major trauma patients sent directly from the emergency department to operating room

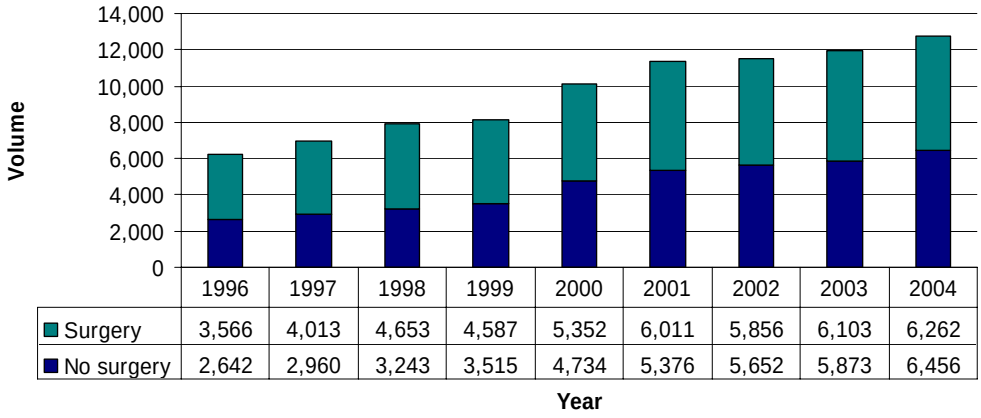


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Mean	122.23	127.73	142.35	130.67	127.8	141.14	137.42	132.5	143.59	133.42
Median	90	100	109	102	107.5	122	110	105.5	120	107
90th Percentile	264	270	315	273	254.5	301	296	269	289	275

Surgical Care

The volume of trauma patients requiring surgery at some point during their hospital admission continues to grow. In 2004, almost half (49.2%) of trauma patients received surgical interventions.

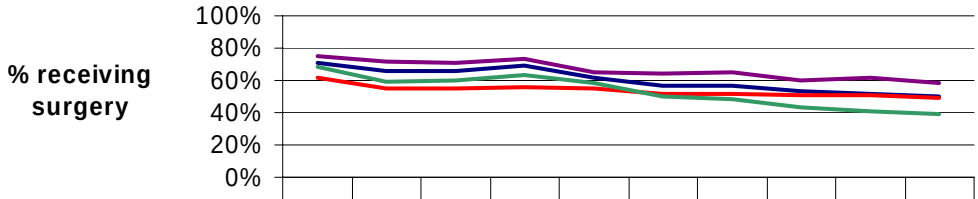
Table 57. Surgery performed for admitted patients by year



	1996	1997	1998	1999	2000	2001	2002	2003	2004
Surgery	3,566	4,013	4,653	4,587	5,352	6,011	5,856	6,103	6,262
No surgery	2,642	2,960	3,243	3,515	4,734	5,376	5,652	5,873	6,456

The proportion of patients receiving surgery has declined over the past ten years. This trend is noticeable in patients with low or high severity injuries as well as those with traumatic brain injuries.

Table 58. Percentage of admitted patients undergoing surgery by injury severity score and/or presence of traumatic brain injury

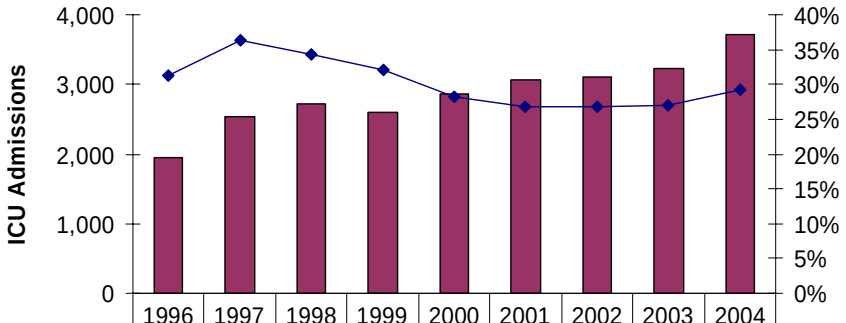


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ISS>=16	71%	66%	66%	69%	62%	57%	57%	53%	52%	50%
ISS<16	62%	55%	55%	56%	55%	52%	52%	51%	51%	49%
ISS>=16 w/o major TBI	75%	72%	71%	73%	65%	64%	65%	60%	62%	58%
ISS>=16 with major TBI	68%	59%	60%	63%	58%	50%	48%	43%	41%	39%

Intensive/critical care

In 2004, 3719 trauma patients were admitted to an intensive care unit. The proportion of admitted trauma patients receiving critical care has remained relatively stable over the past five years.

Table 59. Intensive care unit admissions by year



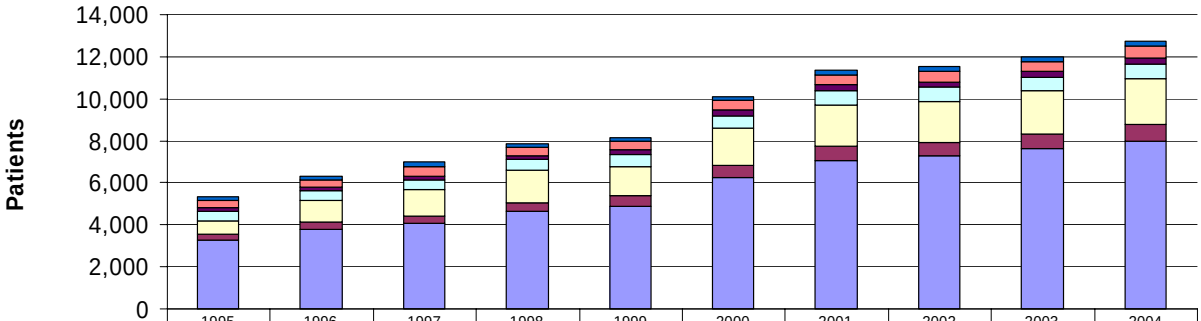
	1996	1997	1998	1999	2000	2001	2002	2003	2004
# ICU Admits	1,946	2,538	2,713	2,591	2,853	3,065	3,098	3,238	3,719
% admitted to ICU	31%	36%	34%	32%	28%	27%	27%	27%	29%

Year

Hospital Disposition

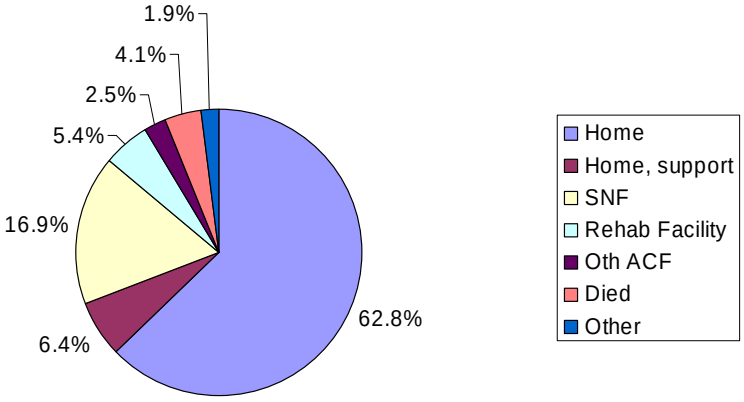
The proportion of admitted trauma patients who experience death in the hospital has dropped from 6.4% in 1995 to 4.1% in 2004. About 2/3 of admitted patients are discharged to home, either independently or with supportive assistance. The proportion of patients discharged to skilled nursing facilities has increased from 12.3% in 1995 to 16.9% in 2004. During the same time, discharges to rehabilitation services decreased from 8.1% in 1995 to 5.1% in 2004.

Table 60. Hospital disposition for admitted patients by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Other	182	183	210	189	126	183	240	216	201	241
Died	342	357	442	400	399	441	482	488	490	524
Oth ACF	184	167	202	185	266	286	291	248	247	321
Rehab Facility	433	415	474	535	534	577	690	681	665	681
SNF	657	1,044	1,219	1,536	1,424	1,776	1,958	1,977	2,042	2,156
Home, support	295	360	388	408	522	548	641	604	719	808
Home	3,249	3,786	4,057	4,635	4,849	6,277	7,078	7,299	7,613	7,990

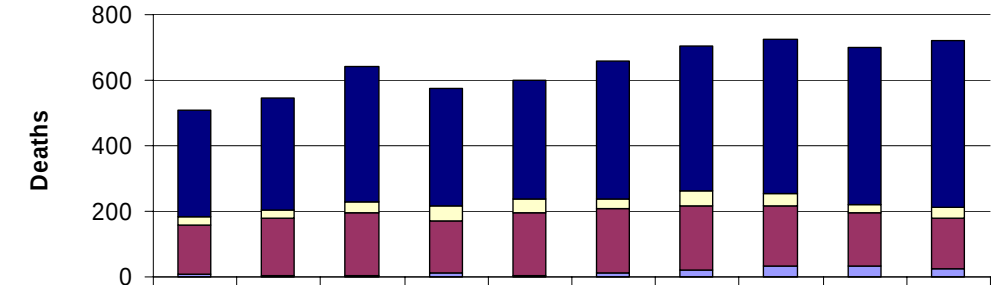
Table 61. Hospital disposition for admitted patients, 2004



Trauma Deaths

The overall number of trauma deaths in the state registry has increased with the increase in overall patient volume. The proportion of deaths pronounced in the emergency department has decreased from 31.6% in 1995 to 25.1% in 2004. About 4% of deaths occur in the operating room, and this proportion has remained stable over this ten year period.

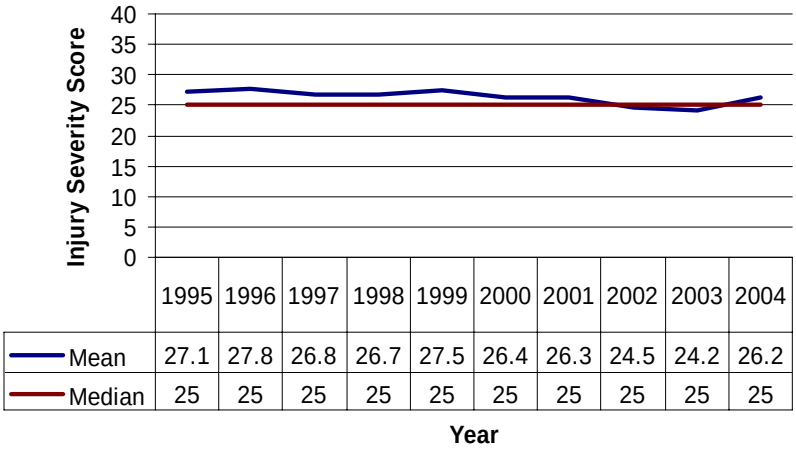
Table 62. Location of death by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Ward/ICU	325	338	411	360	364	420	445	467	480	508
OR	22	28	36	45	42	31	46	41	27	32
ED	151	175	189	160	191	195	194	183	161	158
DOA	9	3	6	11	5	12	21	32	33	23

The mean and median Injury Severity Score of traumatic deaths has remained relatively unchanged over the first ten years of the trauma system.

Table 63. Injury Severity Score of deaths by year

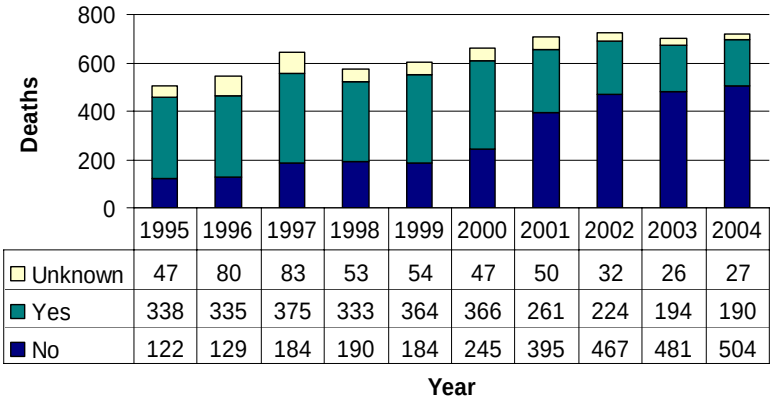


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Mean	27.1	27.8	26.8	26.7	27.5	26.4	26.3	24.5	24.2	26.2
Median	25	25	25	25	25	25	25	25	25	25

Autopsies for trauma deaths

Autopsies can provide important information for trauma quality improvement. The proportion of trauma deaths receiving autopsies has decreased dramatically from 66.7% in 1995 to 26.4% in 2004.

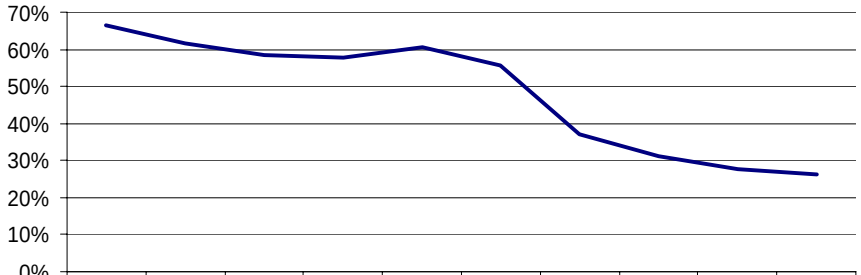
Table 64. Autopsy performed for trauma deaths by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Unknown	47	80	83	53	54	47	50	32	26	27
Yes	338	335	375	333	364	366	261	224	194	190
No	122	129	184	190	184	245	395	467	481	504

Year

Table 65. Proportion of trauma deaths receiving autopsies by year



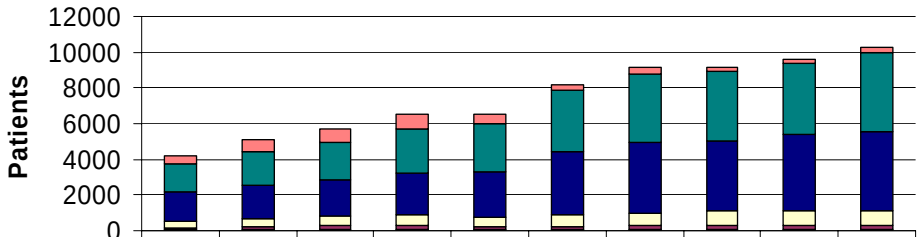
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Autopsy	66.7%	61.6%	58.4%	57.8%	60.5%	55.6%	37.0%	31.0%	27.7%	26.4%

Year

Impairment and disability for survivors

The trauma registry includes a functional independent measure (FIM) to characterize patient disability or impairment at discharge. The FIM components (self-feeding, expression, and locomotion) provide a useful summary measure of disability at discharge from acute care. This impairment may or may not be permanent, and the trauma registry does not include follow-up data on impairment after discharge. The FIM score ranges from 3 (totally dependent) to 12 (totally independent). More than half of admitted trauma patients who survive their injuries are discharges with some impairment as evidenced by a FIM score of less than 12. Less than 1% of survivors are totally dependent at discharge.

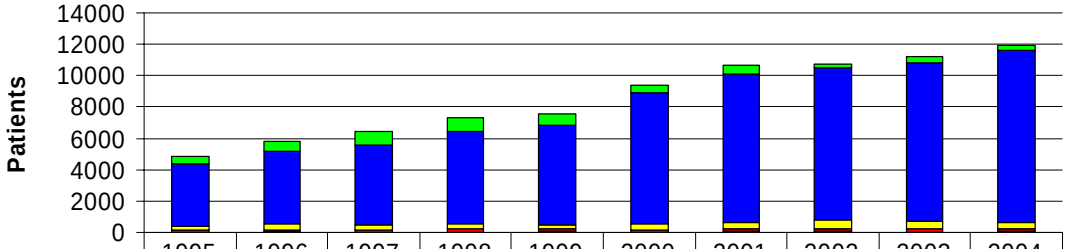
Table 66. Functional independence measure at discharge for survivors (age>=15) by year



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Unknown	450	642	778	847	521	307	369	265	281	368
12	1,609	1,880	2,046	2,451	2,732	3,461	3,852	3,832	3,979	4,360
10-11	1,613	1,869	2,025	2,286	2,512	3,523	3,989	3,918	4,236	4,465
7-9	372	466	570	631	530	638	699	845	824	836
4-6	86	128	173	196	143	149	168	189	204	189
3	72	98	102	108	112	92	100	104	101	91

Traumatic brain injuries may lead to long-lasting cognitive impairment. The trauma registry includes Glasgow Coma Scale (GCS) at discharge. The GCS is a widely used index that assesses the degree of coma in patients with craniocerebral injuries. The GCS components (eye opening, verbal response, and motor response) create a summary score ranging from 3 (comatose) to 15 (no coma indicated). In 2004, 94.2% of survivors aged 2 and older were discharged with a GCS of 15. Less than ½ of 1% were discharged with substantial severe cognitive impairment (GCS<8).

Table 67. Glasgow Coma Score at discharge by year
(Survivors, Age>=2)



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Unknown	501	673	801	854	668	540	539	288	418	378
15	3,941	4,609	5,090	5,894	6,345	8,359	9,489	9,725	10,150	10,906
14	231	331	350	359	310	327	450	524	471	457
8-13	129	151	131	190	163	157	152	192	179	170
3-7	38	40	32	32	42	36	47	44	32	43

Finance

Financial data from participating trauma services have improved, but remain challenging. About 6% of records were missing payer information in 2004 compared to 14.2% in 1995. Hospital charges are available for 80% of records – an improvement from 64.5% in 1995.

Table 68. Primary payer for trauma records by year

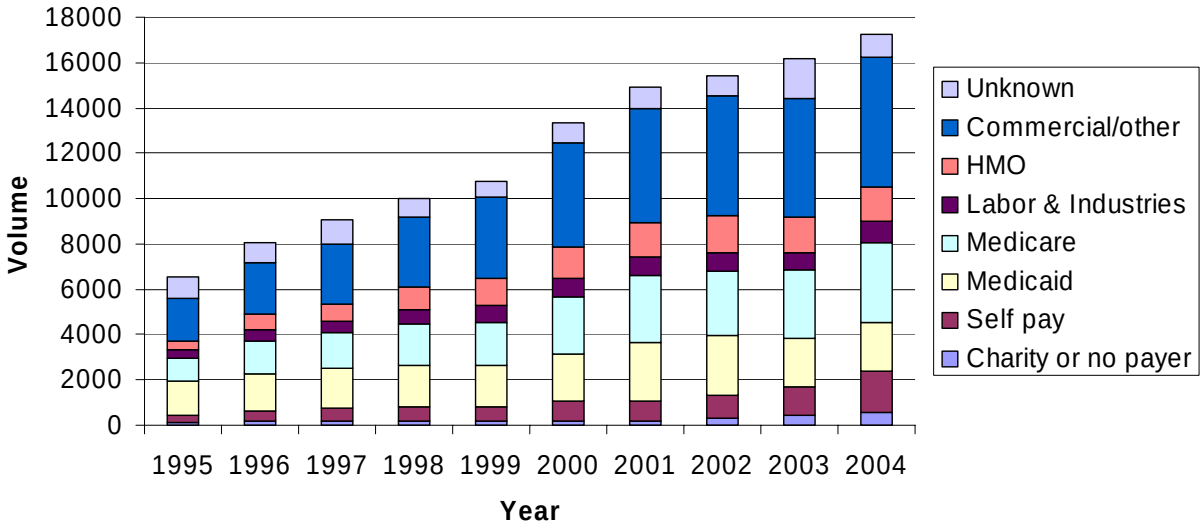
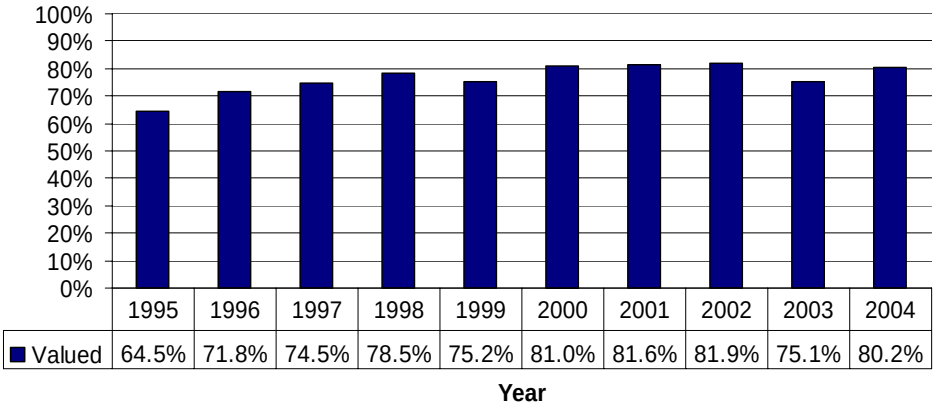
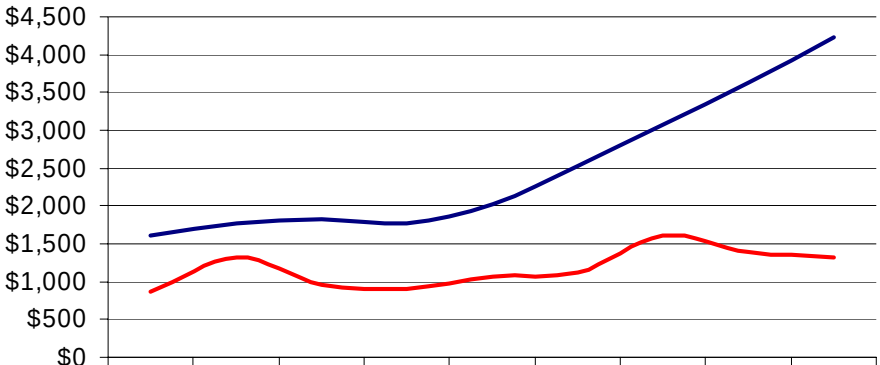


Table 69. Proportion of trauma registry records with hospital charges available



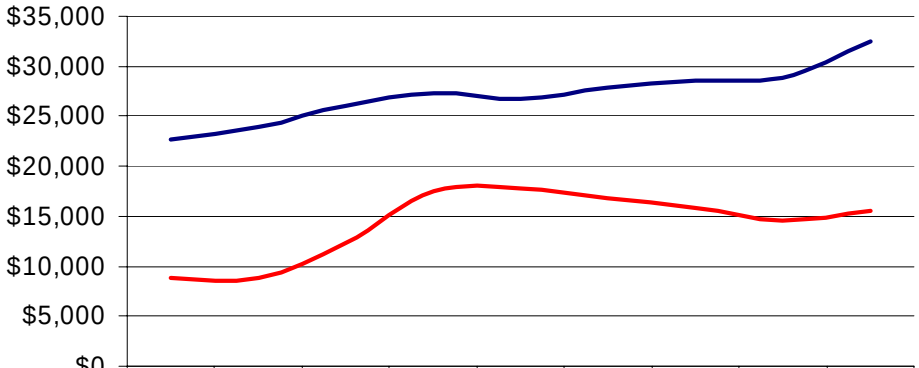
Mean charges appear to be increasing faster than mean reimbursement for patients transferred from the emergency department to another acute care facility as well as for patients admitted to the hospital.

Table 70. Mean charges and reimbursement by year for patients transferred from ED to another acute care facility



	1996	1997	1998	1999	2000	2001	2002	2003	2004
Charges	$1,604	$1,763	$1,828	$1,770	$2,023	$2,532	$3,065	$3,639	$4,237
Reimbursement	$867	$1,318	$966	$905	$1,059	$1,117	$1,607	$1,389	$1,319

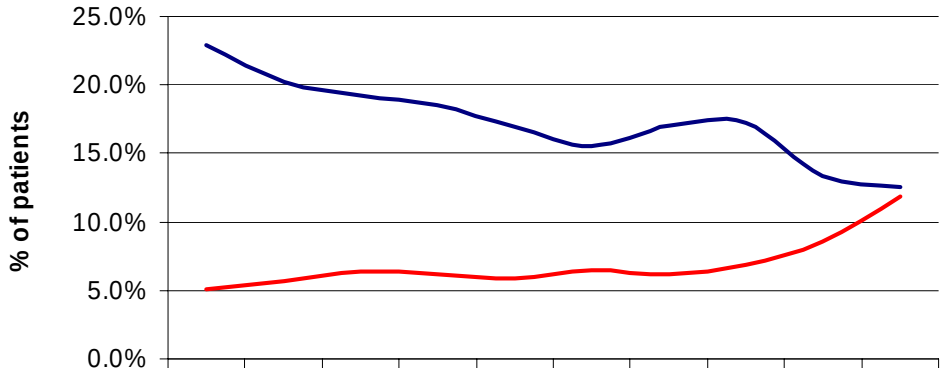
Table 71. Mean charges and reimbursement by year for patients admitted to the hospital



	1996	1997	1998	1999	2000	2001	2002	2003	2004
Charges	$22,635	$23,902	$26,097	$27,317	$26,725	$27,797	$28,526	$28,771	$32,529
Reimbursement	$8,769	$8,792	$12,305	$17,552	$17,742	$16,869	$15,793	$14,599	$15,607

The proportion of trauma patients has decreased from 22.9% in 1995 to 12.5% in 2004. During the same period, self-pay patients and those identified as charity care increased from 5.1% of volume in 1995 to 11.8% in 2004.

Table 72. Proportion of patients with Medicaid vs. self/charity as primary payer by year



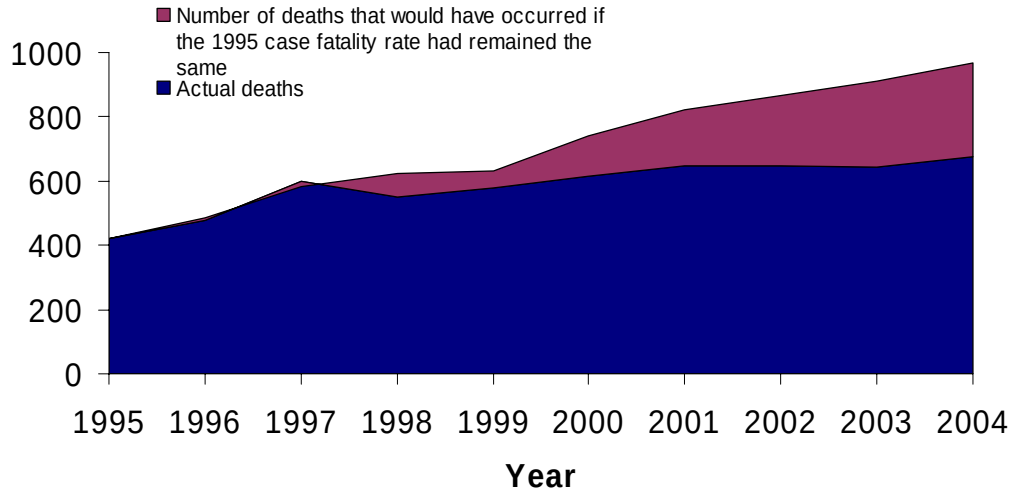
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Medicaid	22.9%	20.2%	19.2%	18.6%	16.9%	15.5%	17.1%	17.2%	13.4%	12.5%
Self/charity	5.1%	5.7%	6.4%	6.2%	5.9%	6.5%	6.2%	6.9%	8.5%	11.8%

Potential lives saved

Since the Washington Trauma System began, in-hospital mortality has decreased. If the 1995 in-hospital performance continued through 2004, an additional 1,190 trauma deaths would have been expected.

Table 73. Potential lives saved

1190 lives potentially saved since the implentation of the Washington Trauma System in 1995



Appendix A

Washington State Trauma Registry Inclusion Criteria

(Revised July 2002)